Planted Forests and Trees Working Paper FP37E

Responsible management of planted forests: Voluntary guidelines

SHOUT
SHARE
IT

Disclaimer

Planted Forests and Trees Working Papers report on issues and activities in the planted forests sector. These working papers do not reflect any official position of FAO. Please refer to the FAO website (www.fao.org/forestry) for official information.

The purpose of these papers is to provide early release of information on ongoing activities and programmes and to stimulate discussion.

Comments and feedback are welcome.

For further information, please contact:

Peter Holmgren, Chief
Forest Resources Development Service
Forest Management Division, Forestry Department
FAO
Viale delle Terme di Caracalla
00153 Rome, Italy
e-mail: Peter.Holmgren@fao.org

or

Jim Carle, Senior Forestry Officer (Plantations and Protection)
Forest Resources Development Service
Forest Management Division, Forestry Department
FAO
Viale delle Terme di Caracalla
00153 Rome, Italy
e-mail: Jim.Carle@fao.org

Bibliographic citation:

FAO. 2006. *Responsible management of planted forests: voluntary guidelines*. Planted Forests and Trees Working Paper 37/E. Rome (also available at www.fao.org/forestry/site/10368/en).

Photo credit:

Planted forests landscape, Bahia, Brazil, courtesy Veracel Company, Brazil.

© FAO 2006

Forestry Department

Food and Agriculture Organization of the United Nations

Planted Forests and Trees Working Papers

Responsible management of planted forests

Voluntary guidelines

Forest Resources Development Service
Forest Management Division
Forestry Department

Working Paper FP/37/E
FAO, Rome, Italy

Responsible management of planted forests

Voluntary guidelines

Contents

Foreword iii

Acknowledgements v

CHAPTER 1. INTRODUCTION 1

1.1 PLANTED FORESTS 1

1.2 ABOUT THE VOLUNTARY GUIDELINES 2

CHAPTER 2. FRAMEWORK OF THE VOLUNTARY GUIDELINES 6

2.1 INTERNATIONAL CONTEXT 6

2.2 NATIONAL AND SUBNATIONAL CONTEXTS 8

CHAPTER 3. GUIDING PRINCIPLES 9

3.1 INSTITUTIONAL PRINCIPLES 9

Principle 1: Good governance 9

Principle 2: Integrated decision-making and multistakeholder approaches 10

Principle 3: Effective organizational capacity 11

3.2 ECONOMIC PRINCIPLES 12

Principle 4: Recognition of the value of goods and services 12

Principle 5: Enabling environment for investment 12

Principle 6: Recognition of the role of the market 13

3.3 SOCIAL AND CULTURAL PRINCIPLES 14

Principle 7: Recognition of social and cultural values 14

Principle 8: Maintenance of social and cultural services 14

3.4 ENVIRONMENTAL PRINCIPLES 16

Principle 9: Maintenance and conservation of environmental services 16

Principle 10: Conservation of biological diversity 17

Principle 11: Maintenance of forest health and productivity 17

3.5 LANDSCAPE APPROACH PRINCIPLES 18

Principle 12: Management of landscapes for social, economic and environmental benefits 18

CHAPTER 4. IMPLEMENTATION CONSIDERATIONS 20

4.1. INSTITUTIONAL ROLES 22

4.2 STRATEGIC AND ECONOMIC PLANNING 24

4.3 STAKEHOLDER RELATIONS 25

4.4 LEARNING AND RESEARCH 26

4.5 OPERATIONAL PLANNING AND MANAGEMENT 27

4.5.1 Biotechnology and genetic modification 28

4.5.2 Herbicides, pesticides, fungicides and other chemicals 29

4.5.3 Fertilizers 29

4.5.4 Planted forests and fire 30

4.5.5 Invasive species 31

4.5.6 Conservation and sustainable use of biological diversity 32

4.5.7 Planted forests and water 33

4.5.8 Rights of indigenous peoples and community customary rights 34

4.5.9 Land tenure and usufruct 35

4.5.10 Employment 36

4.5.11 Application of incentives 37

ANNEXES 39

ANNEX 1: ORIGIN OF THE VOLUNTARY GUIDELINES 41

ANNEX 2: CLASSIFICATION OF NATURALLY REGENERATING AND PLANTED FORESTS AND TREES OUTSIDE FORESTS 43

ANNEX 3: GLOSSARY 45

ANNEX 4: INTERNATIONAL COMMITMENTS 53

ANNEX 5: BIBLIOGRAPHY 58

ANNEX 6: FAO WORKING PAPER SERIES ON PLANTED FORESTS 69

Foreword

The quest for sustainable forest management has received considerable attention in international negotiations. The Rio Declaration, United Nations conventions – the Framework Convention on Climate Change, Convention on Biological Diversity and Convention to Combat Desertification – the United Nations Forum on Forests and other international processes, meetings and key publications have recognized the critical role of forestry in achieving sustainable development.

Planted forests, established through afforestation or reforestation, have a particularly important role to play in providing a wide range of goods and services. There is increasing public awareness that wood products have advantages over competing products made of other materials (cement, plastics and metal) in that wood is renewable, energy efficient and environmentally friendly if managed responsibly.

In the past, planted forests have not always lived up to their potential. Lack of knowledge, capacity and capability in providing enabling policies, laws, regulations, plans and technical support systems has rendered support for responsible planted forest management difficult. As a result, some planted forest investments have created land-use, social and environmental conflicts, as well as suboptimal performance in the areas of health, vitality, productivity and return on investment.

FAO was asked to coordinate a process to strengthen country capacity to balance the social, cultural, environmental and economic dimensions of planted forest management and to increase their contributions towards sustainable livelihoods and land use. The two-year multistakeholder process involved experts in planted forests from governments, the private sector (corporate and smallholder), non-governmental (social and environmental) and intergovernmental organizations and academics. The process identified critical niches for a set of voluntary guidelines, not legally binding, for key decision-makers for planted forests in order to link international, national and local enabling environments.

Earlier versions of the guidelines have been available on the Internet since March 2006 and a wide range of stakeholders have provided feedback. Extensive dialogue has taken place through FAO invitations to governmental forest authorities, private-sector associations, networks of non-governmental organizations and statutory bodies of FAO. The draft guidelines were discussed at meetings of the FAO Regional Forestry Commissions, the Forest Dialogue (Gland, 2005; China, 2006), the World Business Council for

Sustainable Development (Sustainable Forest Industries Working Group) (Beijing, 2006), the International Council for Forest and Paper Associations (Rome, 2006) and the Advisory Committee for Paper and Wood Products (Australia, 2004; Rome, 2005 and 2006). Thus there is a strong sense of ownership among the many stakeholders that have worked closely with FAO and its partners in the preparation of the voluntary guidelines.

I look forward to continuing the process of collaboration on the guidelines with partners and stakeholders in the future. I also look forward to continued cooperation with governments, the private sector, non-governmental organizations and other civil society groups in implementing the guidelines.

Peter Holmgren
Chief

Jim Carle
Senior Forestry Officer

Forest Resources Development Service

Acknowledgements

These voluntary guidelines have been derived through an extensive multistakeholder process coordinated by FAO over a period of two years. Experts in planted forests from governments, the private sector (corporate and smallholder), non-governmental (social and environmental) and intergovernmental organizations and academics gave willingly of their valuable resources, time and expertise to explore the correct balance for the guidelines. FAO wishes to acknowledge its major partners in preparing the early concepts and drafts:

- **governments** of some FAO Member Countries: China, India, Islamic Republic of Iran, New Zealand, South Africa and Viet Nam;
- **intergovernmental organizations:** Center for International Forestry Research, International Tropical Timber Organization and World Agroforestry Centre;
- **private-sector associations:** International Council for Forest and Paper Associations, Brazilian Paper and Pulp Association/Sociedade Brasileira de Silvicultura, American Forest and Paper Association, Confederation of European Paper Industries, Portuguese Paper Industry Association, Japanese Paper Association/Japanese Overseas Plantation Centre for Pulpwood, Corporación Nacional de la Madera – Chile, Swedish Federation of Forest Owner's Associations and New Zealand Private Forest Owners Association;
- **non-governmental organizations:** World Conservation Union, World Wide Fund for Nature, Forest People's Programme, International Institute for Environment and Development and International Federation of Building and Wood Workers/Building and Wood Workers International; and
- **academics:** University of Oxford.

FAO invited the government forest authorities of all countries to comment on the draft versions and held discussions and workshops in association with FAO Regional Forestry Commission meetings. The Organization is indebted to these various stakeholder groups, particularly governments, for their valuable feedback.

Additional feedback from the private sector, non-governmental organizations and other civil-society groups was obtained through international fora coordinated by the FAO Advisory Committee on Paper and Wood Products, Forest Dialogue, International Council of Forest and Paper Associations and World Business Council for Sustainable Development (Sustainable Forest Products Industries).

Further acknowledgements to Jim Ball and Ian Armitage for authoring and review of the draft document, to Lynn Ball for editing and layout, Roberto Cenciarelli for cover preparation, Veracel Company in Bahia, Brazil, for the cover photo and to Graciela Andrade for administrative support to the process.

Chapter 1. Introduction

1.1 Planted forests

Planted forests account for about 7 percent of global forest area or about 2 percent of global land area, i.e. slightly less than 300 million hectares. At the same time, they provide more than half the industrial wood produced in the world and their extent and productivity are increasing. Compared with naturally regenerating forests, planted forests represent a higher investment per area unit and normally produce higher values through their products and services. They are also diverse in size and type, ranging from smallholdings to industrial estates and from primarily protective functions to a wood production orientation. Planted forests stretch from boreal to tropical zones and use native and introduced tree species. They are also sometimes controversial: achieving a balance among sociocultural, environmental and economic benefits can be a challenge.

Forests, including planted forests, supply wood, fibre, fuelwood and non-wood forest products for industrial and non-industrial uses. The benefits of wood products over competing products (of cement, plastics and metal) are that they are renewable, energy efficient and environmentally friendly. Planted forests, when managed responsibly, can also contribute towards the provision of environmental services (soil and water protection, rehabilitation of degraded lands, restoration of landscapes, habitat development and carbon sequestration) and of social services and livelihood support (regional development, income generation, employment and recreation). They may also offset pressure for wood production from primary forests and valuable forest ecosystems.

Forests appear in many types in most ecological zones. They vary widely in cover, structure and species composition. Fitting all forests into a few global classes is thus a challenge. It is, however, well established that forests can be described along a continuum of naturalness and, at the same time, of management impact on the structure and composition of the forest. FAO's Global Forest Resources Assessment process has established four classes along this continuum:

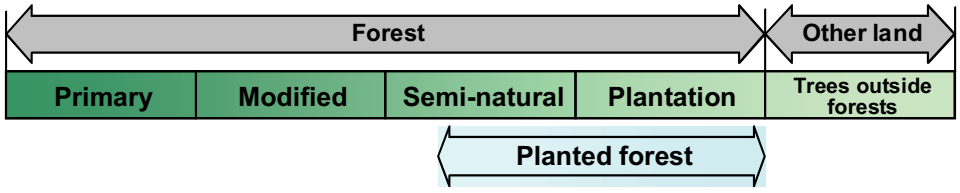
1. primary forest;
2. modified natural forest;
3. semi-natural forest; and
4. forest plantation.

In addition to these forest classes, woodlands and 'trees outside forests' in agricultural landscapes and urban areas are recognized as forest resources. Planted forests include forest plantations and the planted part of semi-natural forests (Figure 1; further details are provided in Annex 2).

The voluntary guidelines frequently refer to 'planted forest management', which means the planning and implementation of all types of regulations, institutional arrangements, research and development activities, policies, monitoring and forest operations related to the planted forest, whether at strategic policy levels or at the operational field level. The term does not, however, refer to activities, processing, marketing or trade related to forest products beyond the forest gate, although linkages with these activities are important to decision-making in planted forest management.

FIGURE

Continuum of forest characteristics from primary forests to trees outside forests, highlighting the scope of planted forests



Adapted from FAO, 2006.

1.2 About the voluntary guidelines

Scope

Recognizing the economic, social, cultural and environmental importance of planted forests, governments and other stakeholders asked FAO to prepare, together with collaborating partners, a set of guiding principles in support of the policy, legal, regulatory and technical enabling conditions for planted forest management.

A process of multistakeholder consultations clarified that the principles and guidelines should help ensure that cultural, social, environmental and economic dimensions be considered and incorporated into planted forest management in a balanced manner. The voluntary guidelines should build on international arrangements related to forests, including criteria and indicators processes and the 'sustainable forest management' concept. While specifically related to planted forests, they should not be seen in isolation from overall forest management, but should provide an example that could be followed for other components of sustainable forest management. Moreover, they should consider existing international law, conventions and agreements outside the forestry-specific dialogue in order to ensure that broader aspirations of sustainable land use, sustainable development and human rights are addressed.

The multistakeholder dialogue on planted forests further indicated that the principles and guidelines should be complemented by technical implementation considerations, a comprehensive bibliography, and annexes clarifying the background and terminology.

The scope of the guidelines is global: they may be adopted and applied to planted forests in all ecogeographical zones and to countries, regions and landscapes in all stages of economic development. Acceptance and implementation of the voluntary guidelines is not legally binding.

The guidelines apply to planted forests that fulfil productive functions for the provision of wood, fibre and non-wood forest products or protective functions for the provision of environmental and/or social services. They cover all aspects of planted forests, from policy development and planning through the technical considerations of planted forest management. Linkages with marketing, industry and trade are also relevant for management decision-making, although not directly addressed here.

The voluntary guidelines do not replace existing national or international laws, commitments, treaties or agreements. Rather, they establish a framework supporting dialogue in the formulation of policies, laws, regulations and strategic and management plans that, in turn, will help improve enabling conditions and enhance capacity and capability in planted forest management.

Forest certification schemes may build upon or complement the guidelines by establishing procedures for and monitoring of technical standards and best practices in planted forest management. It is acknowledged that where planted forests are certified by recognized, credible certification schemes, the intent of these guidelines is likely to have been satisfied. Similarly, where national or

subnational guides, codes of practice or other forest practice systems applying to planted forests exist and have been reviewed against nationally and internationally based standards, they are likely to have satisfied the intent of the voluntary guidelines.

The capacity-building required to implement the guidelines will contribute to meeting national implementation and reporting requests for various international conventions, agreements and other undertakings, some of which are described in Section 2.

Objectives

The objectives of the voluntary guidelines are to:

- promote the positive contribution that planted forests can make to meeting people's livelihood needs, including food security, the production of wood and the safeguarding of environmental values;
- codify generally accepted principles for strengthening the policy, legal and institutional enabling framework for sound investment in and management of planted forests, including the economic, cultural, social and environmental dimensions of sustainable forest management; and
- contribute to an improved understanding of planted forests, in order to aid the formulation and implementation of national and subnational planted forest policies and programmes.

The intent has been to propose practical voluntary guidelines that, in particular, may promote planted forest investment and management across a wide range of situations – including to owners of small forest areas.

Users

The primary users of the voluntary guidelines will be government policy, legal, regulatory and planning decision-makers, investors (public or private, corporate or smallholder) and forest managers, including stakeholders in communally owned or managed forests.

It is recognized that the capacity and capability of the users and the context of uses will vary according to the diverse national, subnational and local levels.

Review and updating

Because the voluntary guidelines are comprehensive, a staged approach to implementation may be necessary, particularly in developing countries.

Based upon guidance and feedback from users, a multistakeholder partnership process, similar to the initial preparation process, should be used periodically to revise the guidelines and the implementation partnership arrangements.

Special requirements of developing countries

The voluntary guidelines may be implemented by countries in all stages of economic development. Moreover, it is recognized that developing countries may require additional support in institutional strengthening and capacity-building in order to provide enabling conditions that support implementation. The principles should be considered by these countries in the process of policy-making and planning, including of the enabling conditions for investment in planted forests. Similarly, countries with economies that are industrialized, in transition or developing can use the guidelines to reassess their existing policy, legal, regulatory, planning and management framework for planted forests.

Chapter 2. Framework of the voluntary guidelines

This section places the guidelines in an international context and describes links with national and subnational stakeholders.

2.1 International context

Nothing in these voluntary guidelines prejudices the rights, jurisdiction and duties of governments under international agreements or their sovereign rights over their forest resources.

International, legally binding instruments that directly impact planted forest investments and management, in chronological order:

- *International Plant Protection Convention* (FAO, 1951, revised 1997) outlines actions to prevent the introduction and spread of pests and diseases of plants and plant products across national borders and promotes measures for their control.
- *World Trade Organization Principles* (WTO, 1955) promote free trade through non-discrimination, reciprocity and transparency, with special treatment of trade from developing countries.
- *Ramsar Convention on Wetlands* (RAMSAR, 1971) is an intergovernmental treaty providing a framework for national action and international cooperation in the conservation and use of wetlands and their resources.
- *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES, 1975) is an agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten their survival.
- *Indigenous and Tribal Peoples Convention* (International Labour Organization – ILO, 1989) contains international standards to protect the rights of indigenous and tribal populations in independent countries.
- *Convention on Biological Diversity* (CBD, 1992) details the principles governing the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits arising from the use of genetic resources.
- *United Nations Framework Convention on Climate Change* (UNFCCC, 1992) aims to stabilize greenhouse gas emissions in the atmosphere, and the Kyoto Protocol to the UNFCCC (1997) provides for mechanisms allowing countries to offset greenhouse gas emissions through afforestation, reforestation and forest management activities.
- *United Nations Convention to Combat Desertification* (UNCCD, 1994) recognizes the delicate balancing needed to achieve sustainable livelihoods and sustainable natural resource management in fragile arid and semi-arid

ecosystems through integrated land-use approaches concorded with major stakeholders.

- *International Tropical Timber Agreement* (ITTO, 1994) provides a framework for sustainable tropical forest management, market transparency, non-discriminatory world timber trade and associated social and environmental considerations.
- *Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade* (United Nations Environment Programme (UNEP) and FAO, 1998) promotes shared responsibility and cooperation in order to discipline international trade in hazardous chemicals and pesticides.
- *Cartagena Protocol on Biosafety* (CBD, 2000) promotes biosafety through practical rules and procedures for the safe transfer, handling and use of genetically modified organisms, with a specific focus on regulating their movement between countries.
- *International Treaty on Plant Genetic Resources for Food and Agriculture* (FAO, 2006) provides standards for the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of benefits derived from their use for sustainable agriculture and food security, in harmony with the Convention on Biological Diversity.

International, non-binding agreements that directly impact planted forest investments and management, in chronological order:

- *International Code of Conduct on the Distribution and Use of Pesticides* (FAO, 1985, revised 2002) is a voluntary global framework that provides guidance on all aspects of pesticide management.
- *Rio Declaration on Environment and Development*, including Chapter II, Agenda 21 and Annex I, details principles to guide states in balancing environmental and developmental considerations in policies and actions; Annex III details the non-binding statement of 'The Forest Principles' for a global consensus on the management, conservation and sustainable development of all types of forests, both natural and planted (United Nations Conference on Environment and Development (UNCED), Agenda 21, 1992).

> *The role of planted forests and permanent agricultural crops as sustainable and environmentally sound sources of renewable energy and industrial raw material should be recognized, enhanced and promoted. Their contribution to the maintenance of ecological processes, to offsetting pressure on primary/old-growth forest and to providing regional employment and development with the adequate involvement of local inhabitants should be recognized and enhanced.*
>
> – United Nations, 1992

- *Code of Conduct for Germplasm Collecting and Transfer* (FAO, 1993) is a voluntary global framework that provides for the rational collection and sustainable use of genetic resources.
- *Intergovernmental Panel on Forests* (IPF, 1995–1997) and *Intergovernmental Forum on Forests* (IFF, 1997–2000) propose actions for sustainable forest management.
- *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources* (FAO, 1996) is a voluntary global framework that provides for the conservation and sustainable use of plant genetic resources for food and agriculture.
- *Declaration on Fundamental Principles and Rights at Work* (ILO, 1998) details the commitment by governments and by employers' and workers' organizations to uphold basic human values vital to our social and economic lives.
- *Millennium Declaration* and *Millennium Development Goals* (United Nations, 2000) uphold human dignity, equity, poverty eradication, protection of the common environment, human rights, democracy, gender equality, good governance and the formation of a global partnership for development.
- *United Nations Forum on Forests* strengthens long-term political commitment to the management, conservation and sustainable development of all types of forests (UNFF, 2000–present).

Many governments have already commited to these international agreements and conventions. More details on international commitments, processes, milestones and recommended readings are listed in Annex 4.

2.2 National and subnational contexts

Incorporation of these voluntary guidelines into national and subnational policies, laws and regulations and into strategic and management plans will help improve enabling conditions. It will also enhance the capacity and capability of policy-makers and planners in national and local governments and of decision-makers, investors and managers in planted forest management.

Although the principles and guidelines are voluntary and non-binding, stakeholders will be encouraged to adopt and abide by them in order to improve the contribution of planted forests to sustainable development, integrated landscape approaches and the engagement of local communities in planning and management where appropriate. The guidelines may also be used to revise existing national or subnational guides, codes of practice and other forest systems that apply to planted forests.

Chapter 3. Guiding principles

This section describes guiding principles for the sustainable management and use of planted forests, as well as key guidelines for each principle. Although the principles are grouped according to institutional, economic, social and cultural, environmental and landscape approaches, they are closely interlinked. Some guidelines are listed under more than one principle to reinforce these linkages. Planted forest policies, planning, management and monitoring need to embrace these principles and guidelines in holistic approaches.

The understanding and application of the principles and recommendations will be determined by the prevailing governance, economic, cultural, social, environmental or other contexts. The extent to which country economies are industrialized, in transition or developing will determine the application of each principle.

The principles apply to all types of institutions, including government, the private sector, non-governmental organizations and civil society, and do not replace existing national or international laws, commitments, treaties or agreements. A comprehensive bibliography for further reading is provided in Annex 5.

3.1 Institutional principles

Principle 1: Good governance

Taking into consideration the time frame and risks in establishing and managing planted forests, as well as their use, marketing and trade, governments should facilitate an environment of stable economic, legal and institutional conditions to encourage long-term investment, sustainable land-use practices and socio-economic stability.

Guidelines include but are not limited to:

- following existing national and international laws, commitments, treaties and agreements;
- encouraging transparency, participation and recognition of the roles of non-governmental stakeholders in decision-making without coercion;

- formulating current, consistent and clear enabling policies, laws, regulations, plans and processes, as well as appropriate monitoring and evaluation systems;
- developing and implementing national and subnational guidelines or codes of practice for the management of planted forests;
- using scientific evidence to weigh the risks, opportunities, costs and benefits of planted forests in relation to conservation and sustainable development;
- providing enabling conditions and procedures that reward sustainable management and responsible practices;
- recognizing just land ownerships (e.g. public and private), the rights and obligations of land and crop tenure, and access for investors (both corporate and smallholder), traditional owners, indigenous peoples, local communities and ethnic minorities;
- distributing benefits on an equitable basis to relevant stakeholders;
- recognizing the rights of workers to organize and to negotiate salaries and conditions to meet their fundamental needs.

Principle 2: Integrated decision-making and multistakeholder approaches

Taking into consideration the multifaceted interfaces of planted forests with communities, agriculture, animal husbandry, naturally regenerating forests and agroforestry land uses, both with and in the landscape, policy-makers should encourage integrated decision-making by stakeholders in planning, managing and utilizing planted forests.

Guidelines include but are not limited to:

- integrating policies, planning and management decision-making related to planted forests into intersectoral and multidisciplinary approaches in order to reflect their role in the wider landscape, both spatially and temporally;
- giving integrated decision-making a scientific, social, environmental and economic basis;
- understanding the varying needs, aspirations, priorities and accountabilities of stakeholder groups, and determining appropriate levels of influence in decision-making in relation to the scale and impact of planted forests;
- encouraging participation in decision-making by corporate and smallholder investors and associations, government and non-governmental organizations, indigenous peoples and local community groups (including women's and marginal groups);
- respecting international law to ensure that local communities and indigenous peoples retain control over their lands, unless they delegate control with free, prior and informed consent;

- finding levels of engagement, dialogue and approval that reflect the real complexity, scale and impact of planted forests, as well as the requirements for timely management decisions;
- recognizing the rights of smallholder investors in planted forests;
- resolving conflicts promptly through mutually agreed conflict management mechanisms involving major stakeholders.

Principle 3: Effective organizational capacity

Governmental, private-sector and other organizations require the capacities and capabilities to deliver knowledge, technology and other support services for sound planted forest management – at all levels.

Guidelines include but are not limited to:

- encouraging decentralization to local levels and devolution of responsibility to improve decision-making;
- providing appropriate and continuing funding mechanisms (for technical support and investment) to ensure the effective capacity and capability of the organizations responsible for development and management of planted forests;
- strengthening institutional capacity to effectively understand and respond to the priority needs and aspirations of major stakeholders;
- improving extension support services and the education and training of staff at all levels in planning, management and technical decision-making;
- strengthening national research capabilities to apply science in policy, management and monitoring of planted forests;
- continuing to learn from science, traditional knowledge and experience;
- sharing knowledge, technology and data through knowledge-management systems, including networking, while respecting intellectual property rights;
- providing support services tailored to the needs of corporate (large-scale) and smallholder (small-scale) investors.

3.2 Economic principles

Principle 4: Recognition of the value of goods and services

Planted forests, whether productive or protective, should be recognized for their provision of both market and non-market benefits, including wood and non-wood forest products and social, cultural and environmental services.

Guidelines include but are not limited to:

- weighing the trade-offs between return on investment to the planted forest investor and the costs and benefits to society of goods and services from planted forests in terms of sustainable livelihoods, land use and forest management;
- improving economic and market valuation to better recognize the full range of goods (wood, fibre, bioenergy, non-wood forest products) and environmental services (storage of carbon, conservation of biological diversity, protection of soil and water and provision of ecotourism, recreation and amenity value) from planted forests;
- sharing benefits on an equitable basis among the stakeholders in planted forests, as well as in related land uses in the landscape;
- developing decision-making support tools to help plan and monitor the provision of goods and services from planted forests, spatially and temporally;
- deriving methods to better reflect the full value of planted forests in justifying investments by governments and private-sector investors (both corporate and smallholder);
- applying the full value of planted forest goods and services in planning, management, monitoring and reporting, particularly by governments and local authorities, including in the setting of land-use priorities.

Principle 5: Enabling environment for investment

Governments should create the enabling conditions to encourage corporate, medium- and small-scale investors to make long-term investments in planted forests and to yield a favourable return on investment.

Guidelines include but are not limited to:

- providing stable and transparent investment, land-use and land management policies, laws, procedures and approval systems in order to give investors the confidence to make long-term investments in planted forests;

- providing direct or indirect incentives to encourage long-term investment in planted forests that may be justified where society as a whole will benefit;
- avoiding or removing perverse incentives having adverse trade, social or environmental impacts, including perverse incentives originating in other sectors;
- reviewing incentives at periodic intervals to address evolution in planted forest investment and management;
- avoiding economic distortions that reduce the value of planted forests or limit the opportunities for smallholder investors;
- promoting equity among competing land uses in policies and priorities.

Principle 6: Recognition of the role of the market

To improve the probability of achieving acceptable returns on investment, investors in planted forests, particularly those having productive functions, should design their planning and management to respond to signals from international and national markets. Establishment and management of planted forests should be market- rather than production-driven, unless established for environmental, protective or civic reasons.

Guidelines include but are not limited to:

- providing transparent access to market information and signals;
- monitoring market intelligence on current markets and future trends, changes in the use of forest products and consumer behaviour;
- creating economic and regulatory policies, legislative regimes, guidelines and practices that provide for fair competition and acceptable rates of return for investors, workers and local economies, and that do not discriminate among appropriate resource uses;
- recognizing the emerging carbon trade markets and the increased understanding of the role of afforestation and reforestation in providing carbon sinks to mitigate climate change, whether planted forests are for productive or protective functions;
- recognizing that the marketplace may not account for all the values that society may enjoy in planted forests.

3.3 Social and cultural principles

Principle 7: Recognition of social and cultural values

Social and cultural values should be taken into consideration in planning, managing and using planted forests, including the welfare and empowerment of adjacent communities, workers and other stakeholders.

Guidelines include but are not limited to:

- recognizing the local community values, customary rights, traditional knowledge, religious values and tenure of indigenous peoples and ethnic minorities in areas targeted for planted forest investments;
- increasing the opportunities and capacity of indigenous peoples, ethnic minorities, local communities (including women and marginal groups) and smallholder investors to benefit from rights in the planning, management and use of planted forests;
- recognizing the various, multiple-use contributions of smallholder investors (including outgrowers) in planted forests and trees and their unique needs for support in terms of tenurial rights, training, extension, research, access to markets and benefit-sharing;
- providing employment, adequate training, equipment and technology for health and safety, and acceptable mechanisms for promoting good practices, especially in considering neighbouring land uses and communities;
- acting to strengthen education, health care and other social services in areas adjoining planted forests.

Principle 8: Maintenance of social and cultural services

The balancing of competing objectives in planted forest investment causes social and cultural changes. Thus it is necessary to adopt planning, management, utilization and monitoring mechanisms to avoid adverse impacts.

Guidelines include but are not limited to:

- introducing socio-economic baselines and long-term impact assessments prior to establishment of planted forests and monitoring changes periodically thereafter;
- establishing conflict-resolution mechanisms to address stakeholder disagreements over tenurial rights, access, social service provision,

employment issues and other rights to social and cultural services that might arise among investors or organizations involved in planted forest investment and management;

- providing a safe, healthy working environment and conditions, in compliance with national or international standards and laws;
- protecting sites and landscapes of archaeological, cultural, traditional, spiritual, scientific, aesthetic or other sociocultural significance;
- respecting community ancestral rights, for example for hunting or the collection of non-wood forest products, when planted forests are not put at risk;
- preventing displacement or resettlement of communities without free, prior and informed consent.

3.4 Environmental principles

Principle 9: Maintenance and conservation of environmental services

Planted forest management will impact the provision of ecosystem services. Thus planning, management, utilization and monitoring mechanisms should be adopted in planted forests in order to minimize negative impacts and promote positive ones, as well as to maintain or enhance the conservation of environmental services.

Guidelines include but are not limited to:

- formulating policy, legal and planning frameworks so as to encourage maintenance, conservation and restoration of environmental functions in planted forests;
- adopting integrated watershed management approaches and the protection of soil from erosion, including the use of appropriate technology and equipment on steep slopes;
- preparing environmental impact assessments consistent with existing legal and policy requirements or where justified by scale and anticipated impact;
- establishing baselines to monitor the impact of planted forest management on abiotic environmental services, such as impact on soil (including salinity), water and air quantity and quality, or where justified by scale and anticipated impact;
- managing planted forest crops to minimize the adverse impacts of fire, pests, diseases and adverse weather conditions, including salvage and restoration following major events;
- considering carbon sequestration and the provision of carbon sinks in the planning, management, utilization and monitoring of planted forests;
- applying sound operational standards and field practices, including contractor arrangements, in the establishment, management, harvesting and utilization of planted forests in order to minimize negative environmental impacts;
- recognizing the positive impact that planted forests can have on the provision of environmental services, including rehabilitation of degraded lands, restoration of landscapes, reclamation of sites and combating of desertification;
- considering voluntary certification programmes an acceptable mechanism for addressing environmental issues.

Principle 10: Conservation of biological diversity

Planners and managers of planted forests should incorporate the conservation of biological diversity at stand, forest and landscape levels.

Guidelines include but are not limited to:

- adapting management practices to help maintain diversity of plants and animals and conserve genetic resources;
- recognizing the role that planted forests can play in relieving harvesting pressures on naturally regenerating forests and in providing habitats for indigenous flora and fauna;
- protecting wildlife habitat diversity and the conservation of forest plants and animals (including aquatic species) by implementing measures from stand to landscape levels;
- preparing baseline studies to monitor the impact of planted forest management on the maintenance of plants and animals and the conservation of genetic resources;
- avoiding the conversion of naturally regenerating forests or other ecosystems of significant conservation value into planted forests;
- controlling illegal practices such as hunting or removal of animals, foraging and harvesting of plants;
- selecting indigenous species for the establishment of planted forests if they are equal to or better than introduced species for the purpose intended;
- evaluating the risk that introduced species may become invasive and have adverse effects on local biodiversity.

Principle 11: Maintenance of forest health and productivity

Arrangements are needed at national, subnational and forest levels to ensure that planted forests are managed so as to maintain and improve forest health and productivity and reduce the impact of abiotic and biotic damaging agents.

Guidelines include but are not limited to:

- recognizing the high productivity of intensively managed planted forests in terms of forest products and services;
- promoting reforestation, soil conservation and other measures after the harvest of planted forests;
- minimizing soil compaction by heavy equipment;

- applying sound biosecurity measures (prediction, prevention, monitoring, rapid response to outbreaks and restoration) to reduce the incidence and impact of invasive species;
- adopting integrated-pest-management approaches and the use of biological control of insects and diseases when possible;
- managing the use of herbicides, pesticides, fungicides and other chemicals responsibly, in accordance with legal requirements and best-practice standards;
- disposing of chemical materials, containers and waste materials in accordance with legal requirements and best-practice standards;
- adopting science-based and regulatory policies, risk-management protocols, practices and monitoring in the use of biotechnology (including genetically modified organisms) in reproductive materials;
- selecting species and reproductive materials with the end-use/product objective, site conditions, environmental impact, genetic diversity and risk of invasiveness in mind;
- reducing the incidence and impact of wildfires by improved prediction, prevention, monitoring, rapid response to emergencies and restoration following fires;
- using planned fire for wildfire hazard and fuel reduction, silvicultural purposes and habitat management;
- avoiding the use of planned fire in land clearing and preparation where science indicates conditions that could be adversely affected by fire;
- undertaking site-establishment practices that maintain or enhance productivity potential and forest health, while minimizing environmental impact;
- practising efficient use of fertilizers, based upon periodic soil, mycoflora and/or foliar analyses and tailored to specific nutrient requirements during the rotation of planted forests;
- supporting education, training, scientific research and networking in forest protection, forest health and the sustainability of site and crop productivity;
- adopting silvicultural management and monitoring practices that balance the trade-offs between maintaining the health and productivity of planted forests and reducing environmental risks, including those from neighbouring land uses.

3.5 Landscape approach principles

Principle 12: Management of landscapes for social, economic and environmental benefits

As planted forests interact with and impact local land uses, livelihoods and the environment, integrated planning and management approaches should

be adopted within a landscape or watershed to ensure that upstream and downstream impacts are planned, managed and monitored within acceptable social, economic and environmental standards.

Guidelines include but are not limited to:

- recognizing the continuum and the respective roles of naturally regenerating forests and planted forests having protective and productive functions and of trees outside forests – to varying degrees, they all provide economic, environmental, social and cultural services within a landscape or watershed, both spatially and temporally;
- educating local communities and the public through outreach programmes, so that they better understand the interrelationships in the management of planted forests, naturally regenerating forests, lands destined for conservation, grasslands, croplands and other land uses;
- retaining naturally regenerating riparian reserves or buffers of varying widths on permanent and, where appropriate, non-permanent water courses, depending upon their size and their conservation importance;
- designing planted forests to provide corridors, where appropriate and practicable, between naturally regenerating forest areas with high environmental conservation value;
- reducing the negative soil- and water-conservation and visual impacts of harvesting and other forest operations;
- designating and managing reserves having significant scientific and cultural value, within which planted forest management will be restricted;
- designating and managing buffer zones adjoining local communities and land uses, where appropriate, to reduce adverse impacts resulting from the management of planted forests;
- locating roads and stream crossings and selecting maintenance programmes appropriate to the landscape (social, cultural, environmental and economic);
- monitoring upstream and downstream water quality and quantity as appropriate.

Chapter 4. Implementation considerations

The Guiding principles (Chapter 3) provides a framework supporting dialogue in the formulation of policies, laws, regulations and strategic and management plans. These, in turn, will help improve enabling conditions and enhance the capacity and capability of decision-makers and managers in planted forest management, whether in government, the private sector or other stakeholder groups.

Chapter 4 summarizes considerations for implementation – to guide those responsible for providing enabling conditions, technical support, investment or management of planted forests. No attempt is made to describe detailed technical guidelines or implementation standards for planning, management and utilization. Stakeholders recognize that the principles and guidelines should be further complemented by technical implementation guidelines tailored to specific ecological zones, purposes, mechanisms of growing, species groups, investors, etc.

Forest certification schemes may build upon or complement the implementation considerations by establishing procedures for and monitoring of technical standards and best practices for planted forest management. Additionally, some regional, national and private-sector forest management standards, guidelines, best practices and accords may already exist.

For effective implementation of the principles and guidelines, it is important to consider these selected cross-cutting issues:

- institutional roles;
- strategic and economic planning;
- stakeholder relations;
- learning and research; and
- operational planning and management.

One overriding consideration in the implementation and sustainable management of planted forest programmes is the long-term nature of forest investment. On one end of the scale, planted forests grown for industrial roundwood and fibre in short-rotation crops in tropical climates may have rotation lengths from establishment to harvesting of 5–10 years; in temperate climates, rotation lengths of 20–40 years; and in boreal climates, in excess of 50 years.

Whether planning, funding, securing land or access, or undertaking tending, silvicultural and protection operations in planted forest management, all

decisions have long-term impacts – with social, cultural, environmental and economic dimensions – on the planted forest estate and on the wider landscape. The voluntary guidelines and implementation considerations will assist policy, legal, planning and management decision-makers and managers in making better long-term decisions and in undertaking more responsible actions to maximize the positive and minimize the negative impacts in planted forest investments and management.

4.1. Institutional roles

Governments, the private sector (corporate and smallholder companies and associations), non-governmental and community-based organizations and other stakeholders have important and diverse roles to play in good governance (Principle 1), integrated decision-making and multistakeholder approaches (Principle 2) and effective organizational capacity (Principle 3). The roles of the respective stakeholders are determined by the unique combination of prevailing political, economic, social, cultural, environmental and geographic conditions.

Successful planted forest management requires that governments formulate policy, legal, regulatory and strategic planning frameworks providing enabling conditions, integrated decision-making and multistakeholder approaches in planted forest investment. These frameworks are supported by education and training, scientific research, stable investment conditions, sound technical knowledge, implementation guidelines, extension services and public awareness. Monitoring of compliance and law enforcement, assessment and reporting of planted forest management for subnational, national, regional and international purposes are also part of the role of government.

Governments can be investors in and managers of planted forests, particularly those fulfilling protective functions such as rehabilitation of degraded lands, combating of desertification and protection of soil and water. Governments may also be investors in and managers of planted forests for productive functions; however, this trend is downwards, as commercialization and privatization of government-owned, productive planted forests increase.

Private-sector entities, both corporate and smallholder, are the most active investors in planted forests; they can more easily mobilize the necessary resources and expertise. Education, training, scientific research, technical support services, extension and awareness-building among the public are increasingly being provided by the private sector or its associations and/or non-governmental organizations. Private-sector and smallholder associations can provide critical links to government and can encourage their members to adopt sound policies, plans and practices in integrated decision-making, multistakeholder participation, setting of operational standards, monitoring of compliance and assessment, and monitoring and reporting.

Trade unions, smallholder associations, community-based organizations and other stakeholders have to engage with government and private-sector investors to ensure that the needs and aspirations of workers, local

communities, indigenous peoples, ethnic minorities, disadvantaged groups – and gender issues – are taken into consideration in planted forest management.

Environmental non-governmental organizations, scientists, academics and other stakeholders have to engage with government and private-sector investors to ensure that matters such as water supply and quality, biological diversity, use of chemicals, biotechnology, fire and invasive species are adequately addressed in planted forest management.

Providing a stable investment climate to build investor confidence is a responsibility only partly within the forestry sector. Other government sectors that impact enabling conditions for investment include, among others, departments of finance, planning, commerce, industries, agriculture, customs, labour and welfare.

4.2 Strategic and economic planning

Consideration of strategic and economic planning issues involves recognition of the value of goods and services (Principle 4); an enabling environment for planted forests investment, including taxes and fees (Principle 5); and recognition of the role of the market (Principle 6) at all levels – national to local. It also relates to integrated decision-making and multistakeholder approaches (Principle 2); recognition of social and cultural values (Principle 7); maintenance of social and cultural services (Principle 8); and integrated planning and management approaches within the landscape (Principle 12).

Strategic, economic and management planning should be applied to large- and medium-scale investments in planted forests. However, smallholders should also undertake a similar process in order to be confident that their investment will yield the intended goods and/or services.

In considering planted forest investments, it is necessary to: evaluate the investment conditions; determine the suitability of the site (ecological zone and landscape conditions); undertake socio-cultural and environmental baseline studies and impact assessments; evaluate status and trends in industries, markets, trade and consumers; survey labour markets, conditions, education and training; and ascertain government policies and public opinion.

If positive signals give the potential investor confidence, particularly with large-scale planted forest investments, then financial and economic feasibility studies, long-term strategic plans and medium-term management plans need to be undertaken and, where required, approved by government authorities. Similar procedures are valid for smallholders, but simpler planning procedures and studies are required.

4.3 Stakeholder relations

Consideration of stakeholder relations is of particular relevance in: good governance (Principle 1); integrated decision-making and multistakeholder approaches (Principle 2); recognition of social and cultural values (Principle 7); and maintenance of social and cultural services (Principle 8).

Regardless of whether planted forest investment is for productive or protective functions, by government or a private investor, and on a large or small scale (corporate or smallholder investor), open dialogue, participation and the sharing of benefits by relevant stakeholders are important to success. This includes respect and facilitation of both 'bottom up' and 'top down' open, cooperative communication to better understand needs, aspirations and proposed development programmes. The process should involve the establishment of consultation mechanisms with the potential for deeper and more trusting relationships and the possible development of partnerships, joint management or investment among corporate and smallholder investors – and even communities.

Where stakeholders are communities, they may not always be in a position to communicate confidently with government or the corporate private sector due to their limited capacity and capability. In these instances, reputable non-governmental, community-based or other organizations are encouraged to work with them to strengthen their capacity and capability.

Social, cultural, environmental, economic and physical landscape conditions may impact planted forests – and vice versa. As a long-term investment, planted forests require particular awareness and diligence at site-preparation, establishment, silvicultural, protection and harvesting interventions in order to avoid negative impacts. The benefits of planted forests accrue towards maturity at the end of the rotation. Early and regular consultations and outreach to stakeholders and the public are essential considerations throughout the planted forest rotation period if their concerns are to be addressed.

4.4 Learning and research

Consideration of the learning achieved through experience and scientific research applies across all 12 principles, but particularly to the economic (Principles 4–6), socio-cultural (Principles 7–8), environmental (Principles 9–11) and landscape-approach (Principle 12) issues.

Adopting a learning culture is essential – through a combination of scientific research, traditional knowledge, education, training and building upon past experience. Planted forest management is not only about planting trees; it involves planning, managing, protecting, utilizing and monitoring the forests in the landscape and watershed over their full rotation. The accelerating emergence of smallholder investors in planted forest investment requires technical support, extension, and market-access systems tailored to their particular needs.

Scientific, social and market research priorities should be established in relevant institutions. Trends in planted forest management (whether productive or protective, large scale or smallholder, government or private sector, long or short rotation) should be taken into consideration in reviewing the curricula of educational and training institutions (university, tertiary and artisan) and of continuing staff-development programmes through in-service training. Adequate, continued funding needs to be assured for education, training and research. Governments and other organizations should promote and provide extension support and services to help smallholders or local communities interested in planted forest investments.

Pilots, demonstrations and successful planted forest management can be used as learning sites – in which the application of scientific and traditional knowledge can be viewed in action through study tours and field trips. Publications and the Internet are also effective tools for sharing knowledge.

4.5 Operational planning and management

Considerations of operational planning and management primarily involve socio-cultural (Principles 7–8), environmental (Principles 9–11) and landscape-approach (Principle 12) issues.

Defining the objectives for planted forest management is important – whether it is primarily for productive or protective functions or a combination of both. Translating the chosen objectives into planted forest management within the context of the prevailing socio-cultural, environmental and economic landscape involves: interpreting market signals (whether goods or services); undertaking environmental, social and cultural baseline studies and impact assessments; determining the mechanisms for interaction and involvement with communities; deciding on the mechanisms for growing; undertaking infrastructure development; and selecting species, rotation, tending, silviculture, protection and harvesting specifications and suitable technologies.

Selected, major operational planning and management issues to be considered in planted forest planning and management – from establishment to harvesting – are discussed below. Issues include those relating primarily to: the environment (Principles 9–12), including genetic modification (GM), herbicides, pesticides, fungicides and other chemicals, fertilizers, fires, spread of invasive species, maintenance and conservation of biological diversity and water; social and cultural issues (Principles 7–8), including the rights of indigenous peoples, community customary rights, land tenure, usufruct and employment; and economic principles (Principles 4–6), including incentives. While these key considerations are not unique to planted forests and pervade the forestry and agriculture sectors, this section highlights how these issues relate to planted forest management.

4.5.1 Biotechnology and genetic modification

Biotechnology excluding genetic modification

The use of improved genetic material, even at provenance level, is fundamental to the success of planted forests. Most species present important intraspecific variability that has to be taken into consideration from the production, adaptation and conservation perspectives. The use of more advanced breeding programmes must consider the need for well-developed silvicultural techniques, genetic variability and 'genotype x' environment interactions. The use of non-GM biotechnology in conventional breeding programmes returns important benefits to planted forests, especially from the perspectives of productivity and forest health and vitality. However, the limitations and possible risks must be taken into consideration, for example the increased risks arising from a narrowing of genetic diversity in bred varieties.

Genetic modification technology

Genetic modification technology is still a relatively new tool in planted forest management. It has potential benefits and drawbacks, but it is not intrinsically good or bad. Each application of this technology to planted forests should be assessed on a case by case basis, under stringent national regulatory conditions, in order to recognize various risks, depending on the biology of trees, the type of genetic modification and how it is deployed in the field. The genetic traits of commercially important tree species most likely to be improved are insect resistance and wood quality, particularly changes in the composition and amount of lignin.

There is a potential for new technology and knowledge in the application of biotechnology, including genetic modifications, to ecological restoration and rehabilitation. As with the products of conventional breeding, genetic modification may entail some risks of gene transfer to breeding populations or wild relatives of a species, potentially leading to hybridization or introgression and other environmental impacts.

GM applications in planted forest management have thus become more than a technical issue: socio-cultural values and the multiple uses of forests need to be taken into account. Public acceptance is necessary if genetically modified forest trees are to be effectively introduced under strict, science-based regulatory conditions.

Validated and effective national and international regulations, strategies and guidelines, such as the Cartagena Protocol on Biosafety, are necessary to the evaluation of risks and impacts associated with genetic modifications in planted forests.

4.5.2 Herbicides, pesticides, fungicides and other chemicals

The control of weeds, insects, diseases and other pests is critical to maintaining planted forest health and productivity. Currently, chemicals are widely used for such control measures; however, the environmental risks involved call for alternatives. Sound selection of species, provenances or hybrid reproductive materials with genetic traits tolerant to these biotic agents, timely maintenance of mechanical and manual tending, silvicultural operations and comprehensive protection monitoring and management can substantially reduce the risk of insect, disease and other pest outbreaks. Careful planning, management and monitoring of weeds, pests and disease threats in planted forests are the keys to maintaining acceptable levels of biosecurity.

Integrated-pest-management (IPM) programmes can improve the health, productivity and sustainability of planted forests – and also improve their ecological sustainability. IPM relies primarily on environmentally benign processes, including the use of pest-tolerant varieties, improved silviculture, protection and management practices, the actions of natural enemies and cultural control. IPM programmes are also economically sustainable: they reduce the manager's dependence on expensive procured inputs, particularly over the rotational period. IPM programmes should be adopted – after risk assessment – where it is practicable and appropriate to do so.

In instances where mechanical, manual or grazing control of weeds or mechanical or cultural control of insects and diseases are not viable, or under conditions of major outbreaks of pests and diseases, or in conditions important to the success of planted forest establishment and management, the controlled and/or restricted use of herbicides, bio-pesticides, fungicides or other chemicals should be considered, including the potential environmental impact of their application. Use of the chemicals should be in compliance with regulations and standards and the *International code of conduct on the distribution and use of pesticides* (FAO, 2002).

4.5.3 Fertilizers

Planted forests have a nutrient cycle from foliage to litter and thence back into the soil. Moreover, the long rotations and deep rooting systems of trees mean

that the weathering of minerals may contribute sufficient nutrients to compensate for losses in harvesting.

However, fertilizers may be used in planted forests to provide healthy seedlings from nurseries; to replace soil nutrients removed in harvesting in short-rotation crops or lost through litter removal; to increase forest productivity when land is limited for new forest development; to provide nutrients on poor soils for the establishment of tree cover in site rehabilitation; and to provide one or more nutrients or trace elements that may be lacking, or in forms that are unavailable, but necessary for plant growth or forest product development.

A significant environmental issue regarding fertilizers in nurseries or in forest planting is over-application of fertilizer, with subsequent nutrient leaching into streams and watercourses, contributing to the eutrophication of water courses and lakes or the accumulation of heavy metals in the environment. The decision to apply fertilizers, in the field or in the nursery, should thus be based on soil, foliar and/or mycoflora analysis, and fertilizer should be applied in an amount to meet the need only.

Consideration should be given to the use of slow-release mineral fertilizers in order to minimize the risk of groundwater contamination or to the use of organic fertilizers, especially in nurseries. The application of fertilizers should be synchronized with periods of the fastest nutrient uptake to achieve minimal loss through leaching.

The application of fertilizers is expensive in the field, and thus the predicted economic benefits should be set against the costs. Certification schemes may discourage the use of fertilizers in planted forest management.

4.5.4 Planted forests and fire

Fire can be a major threat to planted forests, particularly where dry litter builds up or an inflammable shrub layer develops. Fire may contribute to the loss of nutrients and to exposure of the soil to erosion. Smoke and other emissions from fires can be serious health hazards. While the release of greenhouse gases from fire is a natural phenomenon, the net release of carbon by wildfires – as a consequence of fire-induced site degradation and lowered carbon sequestration potential – is contributing to the human-induced increase of the greenhouse effect and global warming.

Planned burning is thus often used in planted forests to reduce the fuel load and avoid a catastrophic outbreak of wildfire, protect planted forests from

such fire and, in some instances, stimulate natural regeneration of fire-dependent species. Fire is also frequently used in land clearing before tree planting. The threats to the soil are recognized, and alternative means of land preparation should be sought where feasible, especially on steep slopes.

Fire management in planted forests needs to be based on prediction, prevention and preparedness, supported by public awareness, monitoring, rapid response and community-based fire management. Fire weather prediction models have been developed in many industrialized countries, while developing countries are improving their capacity and capability for predicting, preparing and preventing destructive fires.

A valuable reference is *Fire management: voluntary guidelines. Principles and strategic actions* (FAO Fire Management Working Paper No. 17, 2006), which outlines voluntary guidelines for fire management, including in planted forests.

4.5.5 Invasive species

Since many introduced or exotic species may adapt to their new environment and regenerate prolifically, great care is required to ensure that such species serve the purposes of the planted forests. In particular, it is essential that they do not get out of control, generating unanticipated negative impacts on native ecosystems or agricultural lands or causing increased fire risk. Introduction of new species should be based upon strict scientific testing and effective regulatory controls.

Prevention is generally much more efficient and cost-effective than eradication and control in addressing the adverse impacts of invasive species. For this reason, decisions on introduced exotic species should be taken carefully, on the basis of a full consideration of the potential risks and benefits. In cases where exotic species are used, effective regulatory controls are important. Planted forests should be managed so as to reduce the possibility of tree and shrub species becoming invasive, particularly when they are well adapted to the environment and/or exhibit characteristics typical of invasive species.

The use of pioneer species with the potential to become invasive may be considered in combating desertification or for rehabilitating severely degraded lands. Their use should be based upon analysis of the risks and benefits – with the participation of stakeholders who understand the possible impacts and risks if introduced – and should be carefully monitored.

4.5.6 Conservation and sustainable use of biological diversity

Biological diversity refers to diversity of flora and fauna, including micro-organisms, and the habitats that support them. At the ecosystem level, its dimensions include the species or gene. Planted forests may significantly reduce the biodiversity on some sites, depending upon management intensity, but they may enhance biological diversity in rehabilitating degraded lands, combating desertification or restoring landscapes. Planted forests can never replace the biodiversity value or benefit of naturally regenerating forests. However, they may reduce harvesting pressure on ecologically significant forest ecosystems elsewhere.

Planted forests should never replace primary forests, ecologically significant secondary forests or other important ecosystems with significant conservation values. These areas should be sustained within planted forest programmes, which should thus be based upon ecosystem-wide planning. Natural genetic diversity should also be sustained, and naturally regenerating forest corridors should be protected, to link blocks of natural forest.

Riparian reserves of naturally regenerating forests should be integrated into planted forest planning and management in order to link these areas and other habitats. It is important to maintain such reserves around lakes and wetlands and along watercourses, the width being determined by the size and permanence of the water body.

Indigenous species are to be preferred for planted forests where they meet the purposes for which the investment is intended or offer improved overall net ecosystem benefits, including for the wider ecosystem and the water balance. Introduced species should be selected in relation to specific management objectives, market conditions and ecological site conditions. Caution should be observed in using genetically modified trees, as their long-term impacts may not be known.

Within the planted forest, management should aim to develop or enhance the diversity of plants and animals. However, such an aim should be secondary in the case of productive planted forests grown for industrial roundwood or fibre supply and should not affect the economic viability or productivity of the planted forest. The use of mixed species and age classes and/or the encouragement of a healthy and diverse understorey in planted forests can promote diversity of associated plants and animals, which can in turn significantly improve forest values and sustainability.

Biodiversity can be encouraged in planted forests through the retention of riparian reserves and original forest remnants and corridors. Particular attention should be given to the role of planted forests in maintaining healthy populations of pollinators such as bees, bats and birds. This can be critical to sustaining nature in surrounding areas, but can also have significant economic benefits for agriculture.

4.5.7 Planted forests and water

Water provides many important ecosystem goods and services. It needs to be managed wisely, and activities that impact water involve trade-off decisions between the services it provides and the benefits of the activity. The economic value of water and the role of land-use activities in its sustainable use within watersheds need to be fully recognized. Water is not a 'free' good. Economic incentives should encourage more effective and rational water management (see Principle 4 on the recognition of the value of planted forest services, Principle 9 on the provision of environmental services, and the attribute of Principle 5 related to avoidance of perverse incentives, including in sectors other than forestry).

Establishing planted forests in arid and semi-arid areas requires careful selection and evaluation of species. Possible impacts on other land uses and on the sustainability of the water cycle should be considered, including both surface and ground water. The challenges are a mixture of both policy- and technology-related environmental and socio-economic considerations and options for integrated watershed management.

Planted forests may play a significant role in regulating water flows and improving water quality. They can be an important mechanism in rehabilitating catchments. As with naturally regenerating forests, they can regulate floods, reduce debris flows and stabilize land, thereby reducing soil erosion that would otherwise lead to excessive sedimentation in rivers and lakes. They can control soil and water salinity and improve soil stability to prevent landslides. Planted forests can thus improve environmental sustainability and the goods and services provided by both land and water when integrated with other watershed management initiatives.

Planted forests may also play an important role in urban and peri-urban localities, particularly in arid and semi-arid areas, by contributing to the recycling of waste water (phyto-remediation) from cities or from industrial activities, particularly where they enhance the functioning of wetlands.

It should not be assumed, however, that the impacts of planted forests are always positive. Inappropriate planting, particularly if using species with high water requirements, can deplete water resources, especially groundwater. This can have major impacts – and often beyond the planted area. Where possible, indigenous species adapted to local soil and water conditions should be used in preference to introduced species. Particular care should be taken in water-stressed and arid and semi-arid areas. Overuse of heavy equipment should be avoided, as this causes soil compaction and impedes hydrology.

The effect of planted forests on water cannot be generalized. Measures should be considered on a case by case basis according to ecological conditions, water resource distribution and availability, the species used and forest management objectives. In policy-making, planning and management, it is critical to keep in mind the impact of planted forests on water supplies and on maintaining equity in the distribution of water in the landscape. The objective should be to maintain the full suite of ecosystem services provided by water at desirable levels. To achieve this, it is important to carry out scientific studies to clarify the impacts of planted forests on water quality and quantity in different situations.

4.5.8 Rights of indigenous peoples and community customary rights

Land that is selected for planted forest investment may be subject to the rights held by indigenous and local communities for such activities as grazing, fodder, collection of traditional foods, medicines or firewood and other uses. Even apparently degraded land may be of great importance to the survival of the poorest, precisely because it is of no economic value to stronger members of the community.

Land selected for planted forests may also contain significant and/or sacred sites. This should be taken into account from the beginning and throughout the planning and management process. If planted forests are to contribute to socio-economic sustainability, indigenous and local community rights and privileges should be considered (see Principle 7).

In the development of planted forests, the rights of ownership and possession of lands that have been traditionally occupied or used by indigenous and local communities should be recognized and respected. Such rights should be safeguarded, including the right to participate in the use, management and conservation of these resources and in any developments proposed to take place on lands and waters traditionally occupied or used by them. Particular attention should be paid to the situation of nomadic peoples and shifting

cultivators. Where the relocation of these peoples is considered necessary, as an exceptional measure, such relocation should take place only with their free and informed consent.

Socio-cultural-economic baselines and impact assessments[1] should identify indigenous and local community rights and interests and assess their importance, with the full and effective participation of such peoples and communities, and paying particular attention to the rights of the poorest and of disadvantaged or marginalized sectors of the community, including women. Such rights should be formally recognized. Conflict resolution mechanisms should be established for the settling of disputed rights, or to determine compensation where the rights have to be temporarily or permanently extinguished.

4.5.9 Land tenure and usufruct

Clarity of land tenure is important to the effective, sustainable development of planted forest programmes. Without secure tenure, the sustainable management of planted forests is not possible. Consequently, the full benefit flows are not possible – whether wood production or the provision of environmental and socio-economic services, including poverty alleviation. Private investors, large or small, corporate, smallholder or community, require the security not only of good governance but also of legal tenure to the land and the crops they own or rent.

Planted forests may be developed under different ownership mechanisms, with the increasing emergence of corporate/smallholder contracts or partnerships. Duration, assurance, robustness and excludability have been identified as being the main legal elements in secure tenure arrangements. While forest policy reforms may be introduced to encourage participation, the laws are often not changed to give clear, formal and long-term recognition of rights and responsibilities, or are not changed completely. Security of tenure may not be robust if all or certain rights are limited by time, or if decision-making power has not been fully devolved.

As with the issue of rights of access or use, the development of secure land tenure for planted forests will require consultation, conflict resolution and

[1] Refer to Akwé: Kon guidelines for the conduct of cultural, environmental and social impact assessments regarding developments proposed to take place on, or which are likely to impact on, sacred sites and on lands and waters traditionally occupied or used by indigenous and local communities (available at www.biodiv.org/doc/ref/tk-akwe-en.pdf).

shared decision-making. The acknowledgement and recognition of customary rights may be necessary. Consultation with other land users will also be necessary. The opportunity may have to be taken to develop a new land-use policy and/or to resolve and harmonize conflicting land-use legislation that may impact tenure. Even decentralization may lead to conflict in tenure, or to marginalized groups being disadvantaged.

4.5.10 Employment

The potential of planted forests to contribute to rural development, including poverty alleviation, is well recognized and is particularly important during times of economic depression. Working conditions should provide safe practices, basic shelter, nutrition and social protection. Equitable sharing of economic benefits with the planted forest workforce is required if local communities are to enjoy the benefits of economic development and poverty reduction.

Planted forest programmes can contribute to rural development through paid employment and through training. The effect of planted forest programmes on rural development as a multiplier of employment at secondary (processing) and tertiary (service) levels can be considerable, especially when a significant portion of the wealth of such value-added activity remains in the local economy and among the forest-dependent workforce.

The establishment, maintenance, tending, silviculture, protection and harvesting of planted forests often involves the employment of unskilled and poorly paid people, resulting in a high employment turnover. In many countries, such work has been associated with high accident rates, fatalities and serious health problems. It is often dominated by men, although women are often employed in forest nurseries.

Contract labour may account for a large and growing share of the planted forest workforce in many countries. The contractors may not be covered by labour legislation and these workers may enjoy much less protection than workers in a formal working relationship. Under pressure to cut costs in a very competitive market, contractors may be forced to overextend themselves and their employees through a high pace of work and excessive working hours or to resort to illegal practices.

One key element in breaking the cycle of low productivity, low wages, high turnover and unsafe work is the empowerment of the forest workforce, smallholders and contract labour. Assisting them to form or strengthen associations helps ensure equitable distribution of benefits, in addition to

building the basis for democratic governance. Vigorous enforcement of core labour standards of the International Labour Organization represents the minimum level of action required to create an enabling environment for the empowerment of large groups of forest workers.

Adequate training is another key element in breaking this cycle. Such training is most effective when designed and delivered by the major group (as defined in Agenda 21) to whom it is targeted. Provision should be made for on-the-job and vocational training for all forest workers, with particular emphasis on health and safety.

Wages, working time, working conditions and work organization arrangements to adapt working life to the demands of life outside work are core elements of the employment relationship and of workers' protection.

4.5.11 Application of incentives

Incentives can be subsidies to reduce costs or to increase returns. They can also be applied in other forms of financial encouragement such as tax reductions and non-pecuniary support in the form of research and extension. The use of incentives needs to be rational and clearly justified in terms of forest or wider economic policies in order to avoid encouraging the wrong outcomes – for example, perverse incentives may encourage the conversion of naturally regenerating forests to planted forests. In the context of conservation and sustainable use of biodiversity, the usefulness of incentive measures was recognized by the conference of the parties (COP) of the Convention on Biological Diversity (Article II).[2]

The decision to establish any form of incentive for planted forest investment should involve investigation into the costs and returns for different investors – for example, corporations or smallholders may require quite different treatment – and into incentives that will cause the least distortion or scope for fraud. Analyses should consider the costs and benefits for both wood and non-wood forest products.

The administration of incentive schemes should be monitored, and care taken to ensure that incentives do not lead to planting that neglects maintenance or subsequent management. In the context of conservation and the sustainable

[2] Convention on Biological Diversity: Convention Text, Article II, Incentive Measures.

use of biodiversity, guidance on the design and implementation of incentive measures was endorsed by COP 6 of the convention (Decision VI/15[3]).

There is a move from direct towards indirect incentives. Rather than paying subsidies to correct distortions in other parts of the economy that discourage planted forest investment, the emphasis is now on the elimination of those distortions and structural impediments and the creation of a business climate that encourages enterprise. Tax system reform may be required, or the elimination of administrative barriers that discourage the marketing of wood or wood products. The need to remove perverse incentives has been recognized by the COP of the convention (see in particular Decision IV/10A[4] and Decision VII/18[5]).

A new source of incentives of considerable potential for planted forest investment may be the provisions of the Kyoto Protocol (of the United Nations Framework Convention on Climate Change) to promote forests as carbon sinks within the context of the Clean Development and Emissions Trading mechanisms.

---

[3] Convention on Biological Diversity: Proposals for the Design and Implementation of Incentive Measures, Annex to Decision VI/15.

[4] Convention on Biological Diversity: Convention Decision IV/10A, paragraph 1f.

[5] Convention on Biological Diversity: Convention Decision VII/18.

Annexes

1. ORIGIN OF THE VOLUNTARY GUIDELINES 41

2. CLASSIFICATION OF NATURALLY REGENERATING AND PLANTED FORESTS AND TREES OUTSIDE FORESTS 43

3. GLOSSARY..... 45

4. INTERNATIONAL COMMITMENTS..... 53

5. BIBLIOGRAPHY 58

6. FAO WORKING PAPER SERIES ON PLANTED FORESTS..... 69

Annex 1: Origin of the voluntary guidelines

Forests play a critical and positive role in sustainable forest management and in wood and fibre supply. Planted forests provide multiple economic, social, cultural and environmental services and benefits. The area of planted forests has thus increased sharply in the past 15 years.

Although planted forests are becoming increasingly important at global and regional levels and in the public and private sectors, performance in the past has not always been successful. Furthermore, there have been some instances of adverse environmental, social and economic effects from public and private planted forest programmes, often related to badly conceived policies, short-sighted planning or poor management practices. These have led to some negative perceptions of planted forests by some decision-makers and the general public.

An authoritative reference has been needed to set out a framework of principles and guidelines in support of the preparation of enabling conditions (institutional and technical) for sound planted forest investment and management.

The concept of voluntary guidelines had emerged from the Expert Meeting on the Role of Planted Forests (New Zealand, 2003) and the Forty-Fifth Session of the FAO Advisory Committee on Paper and Wood Products (Australia, 2004). In line with its mandate and in response to requests from Member Countries,[6] FAO undertook to coordinate the process of preparing draft voluntary guidelines with collaborating partners and through a multistakeholder process. Core group meetings were held in January and September 2005 and an expert consultation in December 2005 to agree on the scope, target users, content, guiding principles and process.

It was agreed that the objectives of the voluntary guidelines would be to:

- provide an overarching framework of principles;
- balance the economic, cultural, social and environmental dimensions of planted forests in the supply of wood, fibre, non-wood products and services; and

[6] For example, the *Report of the 2005 Session of FAO's Committee on Forestry* states (paragraph 54): "The Committee strongly supported the continued focus of FAO on technical advice, capacity-building and knowledge dissemination on best practices, including on such topics as planted forests...."

- contribute positively to sustainable forest management, integrated land use and livelihoods.

It was agreed that the scope of the voluntary guidelines would include forest plantation and the planted component of semi-natural forests (see Annex 2), and would cover the full spectrum of planning, management and monitoring activities for both productive and protective functions.

It was further agreed that the voluntary guidelines be non-legally binding, adapted primarily to the needs of governments and investors (both public and private), policy-makers, planners and managers. They would complement the various forest certification schemes in existence without detracting from these schemes. Thus it was decided by the stakeholders that the core should be the principles and guidelines, with less emphasis on the technical guidelines for implementation practices.

It was agreed that the voluntary guidelines be authoritative, positive and prescriptive in style and language, while avoiding detail.

From late 2004 through 2006, the multistakeholder process has involved experts in planted forests from governments, private-sector associations (corporate and smallholder), non-governmental (social and environmental) and intergovernmental organizations and academics. Drafts of the guidelines were posted on the Internet from March 2006. Governments, private-sector associations, non-governmental organization networks and other stakeholder groups were asked to hold meetings and provide feedback on the guidelines. FAO formally invited feedback by countries through the governmental forest authorities of all countries. The guidelines were introduced and discussed within the six FAO Regional Forestry Commissions as inputs to the Committee on Forestry (Rome, 2007). They were also discussed in the Forest Dialogue (Gland, 2005; China, 2006), World Business Council for Sustainable Development – Sustainable Forest Industries Working Group (Beijing, 2006), International Council for Forest and Paper Associations (Rome, 2006) and the Advisory Committee for Paper and Wood Products (Australia, 2004; Rome, 2005 and 2006).

The extensive dialogue and feedback from these stakeholder groups was used to revise the voluntary guidelines. With the collaboration of the multistakeholder groups, further refinements and strengthening of the guidelines are proposed to continue in the future.

Annex 2: Classification of naturally regenerating and planted forests and trees outside forests

				Planted forests subgroup		
Primary	**Modified natural**	**Semi-natural**		**Plantation**		**Trees outside forests**
				Productive	Protective	
Forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed	Forest of naturally regenerated native species where there are clearly visible indications of human activities	**Assisted natural regeneration** through silvicultural practices for intensive management • weeding • fertilizing • thinning • selective logging	**Planted component** Forest of native species, established through planting, seeding or coppice of planted trees	Forest of introduced species and in some cases native species, established through planting or seeding mainly for *production of wood or non-wood goods*	Forest of native or introduced species, established through planting or seeding mainly for *provision of services*	Stands smaller than 0.5 ha; trees in agricultural land (agroforestry systems, homegardens, orchards); trees in urban environments; and scattered along roads and in landscapes
			FOCUS: VOLUNTARY GUIDELINES FOR PLANTED FORESTS			

Sources: Del Lungo, A. and Carle, J.B., 2005, Global Planted Forest Thematic Study – Supplement to Forest Resources Assessment, FRA 2005, Planted Forests Working Paper FP/35, Rome, FAO; and FAO, 2005, Global Forest Resources Assessment update 2005, Specification of National Reporting Tables for FRA 2005, Rome.

Annex 3: Glossary

Definitions marked with an asterisk (*) have been taken from the Global Forest Resources Assessment 2005 (FRA 2005) (www.fao.org/forestry/site/fra2005-terms). These, in turn, may have been taken from primary sources such as the International Union of Forest Research Organizations (IUFRO) or the Convention on Biological Diversity, and these sources are indicated.

Afforestation*

Establishment of forest plantations on land that, until then, was not classified as forest.

Implies a transformation from non-forest to forest.

Biodiversity* (also Biological diversity)

The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (from the Convention on Biological Diversity, art 2: www.biodiv.org/convention/articles.asp?lg=0&a=cbd-02).

Carbon sequestration

The uptake and storage of carbon. Forests, trees and plants absorb carbon dioxide, release the oxygen and store the carbon.

Carbon sink

Forest and other ecosystems that absorb carbon, thereby removing it from the atmosphere and offsetting CO_2 emissions. The Kyoto Protocol allows certain human-induced sink activities undertaken since 1990 to be counted towards Annex I Parties' emission targets.

Clean Development Mechanism

The Clean Development Mechanism (CDM) is one of the flexible mechanisms of the Kyoto Protocol designed to make it easier and cheaper for industrialized countries to meet the greenhouse gas emission reduction targets that they agreed to under the protocol. Under the CDM, an industrialized country with a greenhouse gas reduction target can invest in a project in a developing country without a target and claim credit for the emissions that the project achieves.

Deforestation*

The conversion of forest to another land use *or* the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.

Disturbances* affecting forest health and vitality

A disturbance is defined as *an environmental fluctuation and destructive event that disturbs forest health, structure and/or change resources or physical environment at any given spatial or temporal scale*. Disturbances that affect health and vitality include biotic agents such as insects and diseases and abiotic agents such as fire, pollution and extreme weather conditions (White and Pickett, 1985; Lindgren and Lewis, 1997, also available at www.mcgregor.bc.ca/publications/InteractionsWithInsectsAndPathogens.pdf).

Employment*

Any type of work performed or services rendered under a contract of hire, written or oral, in exchange for wage or salary, in cash or in kind. (Based on definitions by ILO and the Employment Security Commission.) Employment may be related to the primary production of goods, or to the provision of services.

ILO Core Labour Standards include the following conventions:

- Convention 29 on Forced Labour, adopted in 1929 and Convention 105 on Abolition of Forced Labour, adopted in 1957
- Convention 87 on Freedom of Association and Protection of the Right to Organise, adopted in 1948
- Convention 98 on the Right to Organise and Collective Bargaining, adopted in 1949
- Convention 100 on Equal Remuneration, adopted in 1951, and Convention 111 on Discrimination (Employment en Occupation), adopted in 1958
- Convention 131 on Minimum Wage Fixing, adopted in 1970
- Convention 138 on Minimum Age, adopted in 1973, and Convention 182 on Worst Forms of Child Labour, adopted in 1999
- Convention 142 on Human Resources Development, adopted in 1975
- Convention 155 on Occupational Safety and Health, adopted in 1981, and Convention 161 on Occupational Health Services, adopted in 1985

Eutrophication

A process by which bodies of water become highly charged with nutrients, leading to massive growth in primary productivity, which may result in the growth of algae ('algal blooms'), leading to reductions in dissolved oxygen and the death of fish and other acquatic life.

Forest*

Land spanning more than 0.5 hectares (ha) with trees higher than 5 metres (m) and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.

- Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 m *in situ*. Areas under reforestation that have not yet reached but are expected to reach a canopy cover of 10 percent and a tree height of 5 m are included, as are temporarily unstocked areas, resulting from human intervention or natural causes, which are expected to regenerate.
- Includes areas with bamboo and palms provided that height and canopy cover criteria are met.
- Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest.
- Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 ha and width of more than 20 m.
- Includes plantations primarily used for forestry or protective purposes, such as rubberwood plantations and cork oak stands.
- Excludes tree stands in agricultural production systems, for example in fruit plantations and agroforestry systems. The term also excludes trees in urban parks and gardens.

Forest certification

A procedure to assess the quality of forest management in relation to a forest management standard. Forest certification is designed to send a market signal to buyers that the products they purchase are derived from forests managed to particular environmental and social standards.

Forest management*

The processes of planning and implementing practices for the stewardship and use of forests and other wooded land aimed at achieving specific environmental, economic, social and /or cultural objectives. Includes management at all scales such as normative, strategic, tactical and operational level management.

Intensive forest management*

A regime of forest management under which silvicultural practices define the structure and composition of forest stands. A formal or informal forest management plan exists. A forest is not under intensive

management, if mainly natural ecological processes define the structure and composition of stands.

Forest resources*

For the purposes of the global forest resources assessments, forest resources include those found in forests and other wooded land and as trees outside forests.

Function*

The designated function refers to the purpose assigned to a piece of land, either by legal prescriptions or by decision of the landowner/manager. It applies to land classified as 'Forest' and as 'Other wooded land'.

Primary function*

A designated function is considered to be primary when it is significantly more important than other functions. This includes areas that are legally or voluntarily set aside for specific purposes.

Secondary function* Other functions.

Introduced species* – see Species

Managed forest/other wooded land*

Forest and other wooded land that is managed in accordance with a formal or informal plan applied regularly over a sufficiently long period (five years or more).

Native species* – see Species

Natural forest*

A forest composed of indigenous trees and not classified as a forest plantation.

Modified natural forest/other wooded land*

Forest/other wooded land of naturally regenerated native species where there are clearly visible indications of human activities.

- Includes, but is not limited to: selectively logged-over areas, areas naturally regenerating following agricultural land use, areas recovering from human-induced fires, etc.
- Includes areas where it is not possible to distinguish whether the regeneration has been natural or assisted.

Primary forest/other wooded land*

Forest/other wooded land of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.

- Includes areas where collection of non-wood forest products occurs, provided the human impact is small. Some trees may have been removed.

Semi-natural forest/other wooded land*

Forest/other wooded land of native species, established through planting, seeding or assisted natural regeneration:

- Includes areas under intensive management where native species are used and deliberate efforts are made to increase/optimize the proportion of desirable species, thus leading to changes in the structure and composition of the forest.
- Naturally regenerated trees from other species than those planted/seeded may be present.
- May include areas with naturally regenerated trees of introduced species.
- Includes areas under intensive management where deliberate efforts, such as thinning or fertilizing, are made to improve or optimize desirable functions of the forest. These efforts may lead to changes in the structure and composition of the forest.

Non-wood forest product (NWFP)*

A product of biological origin other than wood derived from forests, other wooded land and trees outside forests (FAO NWFP Web site: www.fao.org/forestry/site/6388/en).

Other wooded land*

Land not classified as 'Forest', spanning more than 0.5 ha; with trees higher than 5 metres and a canopy cover of 5–10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.

Plantation forest or forest plantation/other wooded land*

Forest/other wooded land of introduced species and in some cases native species, established through planting or seeding.

- Includes all stands of introduced species established through planting or seeding.
- May include areas of native species characterized by few species, even spacing and/or even-aged stands.

- Plantation forest is a subset of planted forest.
- Productive plantation* (in forest/other wooded land)
- Forest/other wooded land of introduced species and in some cases native species, established through planting or seeding mainly for production of wood or non-wood goods.
- Includes all stands of introduced species established for production of wood or non-wood goods.
- May include areas of native species characterized by few species, straight tree lines and/or even-aged stands.

Protective plantation* (in forest/other wooded land)

Forest/other wooded land of native or introduced species, established through planting or seeding mainly for provision of services.

- Includes all stands of introduced species established for provision of environmental services, such as soil and water protection, pest control and conservation of habitats to biological diversity.
- Includes areas of native species characterized by few species, straight tree lines and even-aged stands.

Planted forest/other wooded land*

Forest/other wooded land in which trees have been established through planting or seeding. Includes all stands established through planting or seeding of both native and introduced species.

Purpose:

Multiple purpose*

Forest/other wooded land designated to any combination of: production of goods, protection of soil and water, conservation of biodiversity and provision of socio-cultural services and where none of these alone can be considered as being significantly more important than the others.

Production*

Forest/other wooded land designated for production and extraction of forest goods, including both wood and non-wood forest products.

Protection of soil and water*

Forest/other wooded land designated for protection of soil and water.

Social services*

Forest/other wooded land designated for the provision of social services. These services may include recreation, tourism, education and/or conservation of cultural/spiritual sites.

Reforestation*

Establishment of forest plantations on temporarily unstocked lands that are considered as forest.

Regeneration

Artificial regeneration

Forests established by artificial regeneration on land that carried forest within the previous 50 years or within living memory and involved the renewal of what was essentially the same crop as before.

Natural regeneration (with assistance)

Forests established by natural regeneration, with deliberate, human silvicultural assistance, including the provision of seed or vegetative reproductive material.

Natural regeneration (without assistance)

Forests established by natural regeneration without deliberate, human assistance, including virgin forests and those regenerated by natural means.

Secondary forest*

Forest regenerated largely through natural processes after significant human or natural disturbance of the original forest vegetation.

- The disturbance may have occurred at a single point in time or over an extended period.
- The forest may display significant differences in structure and/or canopy species composition in relation to nearby primary forest on similar sites.

Species

Introduced species*

A species introduced outside of its normal past and current distribution.

Note: Its synonyms are ‘alien species’ and ‘exotic species’.

Native species*

A native species is one which naturally exists at a given location or in a particular ecosystem, i.e. it has not been moved there by humans (CBD Web site: www.biodiv.org/programmes/areas/forest/definitions.asp). The term 'native species' is synonymous with 'indigenous species'.

Silviculture*

The art and science of controlling the establishment, growth, composition, health and quality of forest and woodlands to meet the targeted diverse needs and values of landowners and society on a sustainable basis (see the Web site of the International Union of Forest Research Organizations: www.iufro.org/).

Tree*

A woody perennial with a single main stem or, in the case of coppice, with several stems, having a more or less definite crown. Includes bamboos, palms and other woody plants meeting the above criteria.

Trees outside forests

Trees outside forests include all trees found outside forests and outside other wooded lands:

- stands smaller than 0.5 ha;
- tree cover in agricultural land, e.g. agroforestry systems, homegardens, orchards;
- trees in urban environments;
- along roads and scattered in the landscape.

Web site: www.fao.org/forestry/site/tof/en.

Annex 4: International commitments

Legally binding instruments

International Plant Protection Convention (FAO, 1951, revised 1997) outlines actions to prevent the introduction and spread of pests and diseases of plants and plant products across national borders and promotes measures for their control (also available at www.fao.org/Legal/TREATIES/004t-e.htm).

World Trade Organization Principles (WTO, 1955–present) promote free trade through non-discrimination, reciprocity and transparency, with special treatment of trade from developing countries (also available at www.wto.org/English/thewto_e/whatis_e/tif_e/fact2_e.htm).

Ramsar Convention on Wetlands (RAMSAR, 1971) is an intergovernmental treaty that provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (also available at www.ramsar.org/key_conv_e.htm).

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1975) is an agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten their survival (also available at www.cites.org/eng/disc/text.shtml#texttop).

Indigenous and Tribal Peoples Convention, No. 169 (ILO, 1989, adopted 1991) provides international standards to protect the rights of indigenous and tribal populations in independent countries (also available at www.ohchr.org/english/law/indigenous.htm).

Convention on Biological Diversity (CBD, 1992) details the principles governing the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the use of genetic resources (also available at www.biodiv.org/doc/legal/cbd-un-en.pdf).

United Nations Framework Convention on Climate Change (UNFCCC, 1992) aims to stabilize greenhouse gas emissions in the atmosphere, and the Kyoto Protocol to the UNFCCC (1997) provides for mechanisms allowing countries to offset greenhouse gas emissions through afforestation, reforestation and forest management activities (also available at http://unfccc.int/resource/docs/convkp/conveng.pdf).

United Nations Convention to Combat Desertification (UNCCD, 1994) recognizes the delicate balancing needed to achieve sustainable livelihoods and sustainable natural resource management in fragile arid and semi-arid

ecosystems through integrated land-use approaches concorded with major stakeholders (also available at www.unccd.int/convention/text/pdf/conv-eng.pdf).

International Tropical Timber Agreement (ITTO, 1994) provides a framework for sustainable tropical forest management, market transparency, non-discriminatory world timber trade and associated social and environmental considerations (also available at http://sedac.ciesin.columbia.edu/entri/texts/ITTA.1994.txt.html).

Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (UNEP and FAO, 1998) promotes shared responsibility and cooperation in order to discipline international trade in hazardous chemicals and pesticides (also available at www.fco.gov.uk/Files/kfile/CM%206119.pdf).

Cartagena Protocol on Biosafety (CBD, 2000) promotes biosafety through practical rules and procedures for the safe transfer, handling and use of genetically modified organisms, with a specific focus on regulating their movement between countries (also available at www.biodiv.org/doc/publications/bs-brochure-03-en.pdf).

International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, 2006) supports the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of benefits derived from their use, in harmony with the Convention on Biological Diversity (also available at www.fao.org/AG/cgrfa/itpgr.htm).

Non-legally binding instruments, arrangements and processes

International Code of Conduct on the Distribution and Use of Pesticides (FAO, 1985, revised 2002) is a voluntary global framework that provides guidance on all aspects of pesticide management (also available at www.fao.org/DOCREP/005/Y4544E/Y4544E00.HTM).

The Forest Principles is the statement of a global consensus on the management, conservation and sustainable development of all types of forests, both natural and planted (United Nations Conference on Environment and Development (UNCED), Agenda 21, 1992) (also available at www.un.org/documents/ga/conf151/aconf15126-3annex3.htm).

Criteria and Indicators Processes (1992–present) such as the Montreal, African Timber Organization, Dry Forest in Asia, Dry Zone Africa, International Timber Trade Organization, Lepaterique, Near East, Pan

European and Tarapoto Processes help promote a better understanding of the concept and criteria and indicators for sustainable forest management (also available at www.fao.org/forestry/site/19527/en).

Code of Conduct for Germplasm Collecting and Transfer (FAO, 1993) is a voluntary global framework that provides for the rational collection and sustainable use of genetic resources (also available at www.fao.org/ag/aGp/agps/pgr/icc/icce.htm).

Intergovernmental Panel on Forests (IPF, 1995–1997) and **Intergovernmental Forum on Forests** (IFF, 1997-2000) propose actions for sustainable forest management (also available at www.un.org/esa/forests/ipf_iff.html).

Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources (FAO, 1996) is a voluntary global framework that provides for the conservation and sustainable use of plant genetic resources for food and agriculture (also available at www.fao.org/ag/AGP/AGPS/GpaEN/gpatoc.htm).

United Nations Forum on Forests strengthens the long-term political commitment to the management, conservation and sustainable development of all types of forests, including an instrument for the sustainable management of forests (UNFF, 2000–present) (also available at www.un.org/esa/forests).

Notable international milestones

Rio Declaration on Environment and Development (1992), including Chapter II, Agenda 21 and Annex I, presents principles to guide states in balancing environmental and developmental considerations in policies and actions; Annex III contains the non-binding authoritative statement of *The Forest Principles* (also available at www.unesco.org/education/information/nfsunesco/pdf/RIO_E.PDF).

Declaration on Fundamental Principles and Rights at Work (ILO, 1998) details the commitment by governments and employers' and workers' organizations to uphold basic human values vital to our social and economic lives (also available at http://training.itcilo.it/ils/foa/library/declaration/decl_en.html).

International Expert Consultation on the Role of Planted Forests in Sustainable Forest Management (1999, Santiago, Chile) was held to assist the Intergovernmental Forum on Forests (IFF) in recognizing and enhancing the role of planted forests as an important element of sustainable forest management. The meeting addressed the underlying causes of deforestation, the needs and requirements of countries with low forest cover, future supply and demand for wood and non-wood products, rehabilitation of degraded

lands and other relevant issues (also available at www.fao.org/forestry/webview/media?mediaId=4599&langId=1).

Millennium Declaration (United Nations, 2000) presents the values and principles of human dignity, equity, poverty eradication, protection of our common environment, human rights, democracy, gender equality, good governance and the formation of a global partnership for development (also available at www.undg.org/content.cfm?id=502).

Millennium Development Goals (United Nations, 2000):

Goal 1. Eradicate extreme poverty and hunger

Target 1. Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day.
Target 2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger.

Goal 2. Achieve universal primary education

Target 3. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.

Goal 3. Promote gender equality and empower women

Target 4. Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015.

Goal 4. Reduce child mortality

Target 5. Reduce by two thirds, between 1990 and 2015, the under-five mortality rate.

Goal 5. Improve maternal health

Target 6. Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio.

Goal 6. Combat HIV/AIDS, malaria and other diseases

Target 7. Have halted by 2015 and begun to reverse the spread of HIV/AIDS.
Target 8. Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases.

Goal 7. Ensure environmental sustainability

Target 9. Integrate the principles of sustainable development into country policies and programmes and reverse the losses of environmental resources.
Target 10. Halve by 2015 the proportion of people without sustainable access to safe drinking water.

Target 11. By 2020 to have achieved a significant improvement in the lives of at least 100 million slum dwellers.

Goal 8. Develop a Global Partnership for Development

Target 12. Develop further an open, rule-based, predictable, non-discriminatory trading and financial system.
Target 13. Address the special needs of the least developed countries.
Target 14. Address the special needs of landlocked countries and small island developing states.
Target 15. Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term.

World Summit on Sustainable Development Declaration (WSSD, 2002) is the political declaration of a commitment to sustainable development, including protecting and managing the natural resource base of economic and social development and sustainable development for Africa (also available at www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POI_PD.htm).

Intersessional Expert Meeting of the UNFF on the Role of Planted Forests in Sustainable Forest Management (2003, Wellington, New Zealand) recommends, *inter alia*: that planted forests play an increasingly important role in the provision of a range of goods and environmental, social and cultural services; that they be considered as a mechanism for the alleviation of poverty; and that sustainable management of planted forests be achieved through the promotion and implementation of good governance frameworks and mechanisms (also available at www.maf.govt.nz/mafnet/unff-planted-forestry-meeting/index.htm).

Annex 5: Bibliography

Sustainable forest management

1 Calder, I.R., Hall, R.L. & Adlard, P.G., eds. 1992. *Growth and water use of forest plantations*. Chichester, UK, John Wiley and Sons.

2 Carpenter, R., ed. 1983. *Natural systems for development – what planners need to know*. New York, McMillan Press.

3 Centre Technique Forestier Tropical. 1989. *Mémento du forestier*. 3ème édition. Ministère de la Coopération et du Développement. Paris, Jouve.

4 CIFOR. 2001. *C&I for sustainable development of industrial tropical tree plantations* (with links to a code of practice). Bogor Barat, Indonesia.

5 CIFOR. 2001. *Code of practice for industrial tree plantation development in the tropics*. Bogor Barat, Indonesia.

6 CIFOR. 2003. *Fast-wood forestry, myths and realities*. Bogor Barat, Indonesia.

7 Consumers Association of Canada (CSA). *Certification of forest products*. Web site: www.csa-international.org/product_areas/forest_products_marking/Default.asp?language=english.

8 Department of Environment and Natural Resources (Philippines), International Tropical Timber Organization (ITTO) & FAO. 2000. *Proceedings of International Conference on Timber Plantation Development*, November, 2000, Manila, the Philippines.

9 Dyck, B. 2003. *Benefits of planted forests: social, ecological and economic*. Presented at the United Nations Forum on Forests (UNFF) Intersessional Experts Meeting on the Role of Planted Forests in Sustainable Forest Management, 24–30 March 2003, Wellington, New Zealand.

10 Eldridge, K., Davidson, J. & van Wyk, G. 1994. *Domestication and breeding of eucalypts*. Oxford, UK, Clarendon Press.

11 Evans, J. 1982. *Plantation forestry in the tropics* (1st edn.). Oxford Science Publications. Oxford, UK, Clarenden Press.

12 Evans, J. 1992. *Plantation forestry in the tropics* (2nd edn.). Tree planting for industrial, social, environmental and agroforestry purposes. Oxford, UK, Clarendon Press.

13 Evans, J. & Turnbull, J.W. 2004. *Plantation forestry in the tropics. Role of silviculture, and use of planted forests for industrial, social, environmental and agroforestry purposes* (3rd edn.). Oxford, UK, Oxford University Press.

14 FAO. 1967. *FAO Proceedings of the World Symposium on Man-Made Forests and Their Industrial Importance,* Canberra, Australia. Volume 1. *Position papers*; Volume 2. *Special invited papers*; and Volume 3. *Voluntary papers*.

15 FAO. 1985. *Ecological effects of eucalyptus.* FAO Forestry Paper No. 59. Rome.

16 FAO. 1988. *Eucalypt dilemma.* Executive summary of Forestry Paper No. 59. Rome.

17 FAO. 1995. *Code of conduct for responsible fisheries.* Rome.

18 FAO. 1996. *Forest codes of practice – contributing to environmentally sound forest operations.* FAO Forestry Paper No. 133. Rome.

19 FAO. 1998. *Guidelines for the management of tropical forests.* Vol. 1. *Production of wood.* FAO Forestry Paper No. 135. Rome.

20 FAO. 2000. *Report of the Panel of Eminent Experts on Ethics in Food and Agriculture.* Rome.

21 FAO. 2002. *Proceedings of Second Expert Meeting on Harmonizing Forest Related Definitions for Use by Various Stakeholders*. Organized by FAO in collaboration with the Center for International Forestry Research (CIFOR), the Intergovernmental Panel on Climate Change (IPCC), International Union of Forest Research Organizations (IUFRO), the International Tropical Timber Organization (ITTO) & the United Nations Environment Programme (UNEP). Rome.

22 FAO. 2003. *State of the World's Forests 2003*. Rome.

23 FAO. 2004. *Global Forest Resources Assessment Update 2005. Specification of National Reporting Tables for FRA 2005.* Rome.

24 FAO. 2005. *Proceedings of Third Expert Meeting on Harmonizing Forest-Related Definitions for Use by Various Stakeholders*. Organized by FAO in collaboration with CIFOR, IPCC, IUFRO, ITTO & UNEP, Rome, January 2005.

25 FAO. 2005. *State of the World's Forests 2005*. Rome.

26 FAO. 2006. *Global Forest Resources Assessment 2005.* FAO Forestry Paper No. 147. Rome.

27 FAO & CIFOR. 2003. *Towards equitable partnerships between corporate and smallholder partners: relating partnerships to social, economic and environmental indicators.* Synthesis of workshop, Bogor Barat, Indonesia, 21–23 May 2002 (also available at www.fao.org/documents/docrep/005/Y4803E/Y4803E00.htm).

28 FAO & the United Nations Development Programme (UNDP). 1992. *Plantation forestry in the South Pacific: a compilation and assessment of practices*. RAS/86/036 Field Document 8, June 1992. Port Vila, Vanuatu, South Pacific Forestry Development Programme.

29 Finnish Forest Certification System (FFCS). Undated. Web site: www.ffcs-finland.org/ pages/english/about-forest-certification.ph.

30 Forest and Trade Asia. Undated. *Practical guidance and news updates on forest certification in Asia and the Pacific region*.
Web site: www.forestandtradeasia.org/.

31 Forest Certification Chile (CERTFOR). Undated. Web site: www.certfor.org/ingles/certfor.htm.

32 Forest Stewardship Council. 2006. *FSC Plantations Review Policy Working Group final report*. Bonn, Germany.

33 Forest Stewardship Council (FSC). Undated. *Forest Stewardship Council and the development of a certification scheme for planted forests* (available at www.fsc.org/en/ work_in_progress/plantations_review).

34 Garforth, M. & Mayers, J. 2005. *Plantations, privatization, poverty and power – changing ownership and management of state forests.* International Institute for Environment and Development (IIED). London, Earthscan.

35 Gillis M. & Repetto, R. 1990. The new forestry, an ecosystem approach to land management. *BioScience*, 40(8): 558–562.

36 Higman S., Mayers J., Judd N. & Nussbaum, R. 2005. *Sustainable forestry handbook* (2nd edn.). London, Earthscan.

37 ILO. 1998. *Declaration on fundamental principles and rights at work*. International Labour Organization, 86th Session, Geneva.

38 Intergovernmental Forum on Forests. 1999. *Role of planted forests in sustainable forest management*. Report of the International Expert Consultation, Santiago, Chile, April, 1999.

39 International Forest Science Consultancy. Undated. *Manual on the management of plantation forests*, by Alistair Fraser. Edinburgh, Scotland.

40 IPPC. 1991. *International Plant Protection Convention*. Rome, FAO.

41 ITTO. 1993. *Conservation of biological diversity in tropical production forests*. ITTO Policy Development Series 5. Yokohama, Japan, International Tropical Timber Organization.

42 ITTO. 1993. *ITTO guidelines for the establishment and sustainable management of planted tropical forests.* Yokohama, Japan, International Tropical Timber Organization.

43 ITTO. 2002. *ITTO guidelines for the restoration, management and rehabilitation of degraded and secondary tropical forests*. ITTO Policy Development Series No 13. Yokohama, Japan, International Tropical Timber Organization in collaboration with CIFOR, FAO, World Conservation Union (IUCN) & the World Wide Fund for Nature (WWF).

44 ITTO. 2006 (in print). *Guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests.* Yokohama, Japan, International Tropical Timber Organization.

45 Kanowski, P. 2005. *Intensively managed planted forests*. Paper prepared for the Forest Dialogue Meeting on Intensively Managed Planted Forests, Gland, Switzerland, June 2005. Canberra, Australia, Australian National University.

46 Kronka, F.J., Bertolani, F. & Ponce, R. 2005. *A cultura do Pinus no Brasil*. São Paulo, Brasil, Sociedade Brasileira de Silvicultura.

47 Laarman, J., Virtanen, K. & Jurvelius, M. 1981. *Choice of technology in forestry, a Philippine case study*. Geneva, International Labour Organization.

48 Lima, W.P. 1996. *Impacto ambiental do eucalipto*. São Paulo, Brasil, Edusp.

49 Metafore. Undated. *MetaFore – conserves, protects and restores the world's forests*. Web site: www.metafore.org/index.php.

50 Millennium Ecosystem Assessment. 2005. *Ecosystems and human well-being.* Volume 1. *Current status and trends*; Volume 2. *Scenarios*; Volume 3. *Policy responses*; and Volume 4. *Multiscale assessments*. Millennium Ecosystem Assessment Series. Washington, DC, Island Press.

51 Mora, A.L. & Garcia, C.H. 2000. *A cultura do eucalipto no Brasil (Eucalypt cultivation in Brazil)*. São Paulo, Brasil, Sociedade Brasileira de Silvicultura.

52 Nussbaum, R. & Simula, M. 2005. *Forest certification handbook* (2nd edn.). London, Earthscan.

53 Poore, D. & Sayer J. 1987. *Management of tropical moist forest lands - ecological guidelines*. Gland, Switzerland, World Conservation Union (IUCN).

54 Price, W.C., Rana, N. & Sample, V.A. 2005. *Plantations and protected areas in sustainable forestry.* Binghampton, NY, Food Products Press.

55 Programme for the Endorsement of Forest Certification. Undated. *PEFC certification.* Web site: www.pefc.org/internet/html.

56 Savill, P.S. & Evans, J. 1986. *Plantation silviculture in temperate regions.* Oxford, Clarendon Press.

57 Sayer, J. 1993. *Plantations in the tropics – environmental concerns*. World Conservation Union (IUCN), in collaboration with the United Nations Environment Programme (UNEP) & the World Wide Fund for Nature (WWF).

58 Sustainable Forestry Initiative Program. 2005. *Sustainable forest initiative (SFI) standard, 2005 – 2009 edition.* A reference document – overview, governance, guidance and historical information. Sustainable forest management principles, objectives, performance measures and indicators applied in the United States and Canada.

59 United Nations. 1992. *Convention on Biological Diversity* (also available at www.biodiv.org/convention/).

60 United Nations. 1992. Non-legally binding authoritative statement of principles for a global consensus on the management, conservation, and sustainable development of all types of forests ('Forest Principles'). In *Report of the United Nations Conference on Environment and Development,* Rio de Janeiro, 3–14 June 1992 (also available at www.un.org/documents/ga/conf151/aconf15126-3annex3.htm and http://habitat.igc.org/ agenda21/forest.htm).

61 United Nations. 1992. *United Nations Framework Convention on Climate Change* (also available at http://unfccc.int).

62 United Nations. 1994. *UN Convention to Combat Desertification* (also available at www.unccd.int/).

63 United Nations. 2000. *United Nations Millennium Declaration*. Resolution adopted by the General Assembly of the United Nations, New York, September 2000.

64 United Nations Environment Programme & FAO. 1999. *Proceedings of the International Meeting on Special Needs and Requirements of Developing Countries with Low Forest Cover and Unique Types of Forests,* Tehran, Islamic Republic of Iran, October 1999.

65 United Nations Forum on Forests. 2003. *Role of planted forests in sustainable forest management*. Report of the United Nations Forum on Forests (UNFF) Intersessional Experts Meeting, 25–27 March 2003, Wellington, New Zealand.

66 Wiersum, K.F. 1984. *Strategies and designs for afforestation, reforestation and tree planting*. Proceedings of an international symposium on the occasion of 100 years of forestry education and research in the Netherlands, Wageningen, September, 1983. Wageningen, Netherlands, Pudoc Wageningen (also available at www.fao.org/documents/DOCREP/005/Y4803E/ Y4803E00.HTM).

Policy and legislation

67 Anderson, D. 1987. *Economics of afforestation: a case study in Africa*. Baltimore, MD, John Hopkins University Press.

68 Bruce J.W. 1998. *Tenure brief. Review of tenure and terminology*. Madison, WI, Land Tenure Center.

69 FAO. 2003. *Multilingual thesaurus on land tenure.* Rome.

70 FAO. 2004. *What does it take? Role of incentives in forest plantation development in Asia and the Pacific*. RAP Publication 2004/7, Bangkok, Thailand, FAO Asia Pacific Forestry Commission.

71 FAO. 2005. *Best practices for improving law compliance in the forest sector*. FAO Forestry Paper No. 145. Rome, International Tropical Timber Organization (ITTO) & FAO.

72 FAO. 2005. *Negotiation and mediation techniques for natural resources management*. Rome.

73 ILO. 2002. *Employment in forestry, wood, pulp and paper*. Geneva, International Labour Organization (also available at www.ilo.org/public/ english/dialogue/sector/sectors/forest/ emp.htm).

74 ILO. 2006. *Conditions of work and employment programme*. Geneva, International Labour Organization (also available at www.ilo.org/public/english /protection/condtrav/).

75 Keipi, K. 1997. Financing forest plantations in Latin America: government incentives. *Unasylva*, 188: 50–56.

76 Kohler, V., ed. 1990. *Integration of management of tropical forests into regional development*. Proceedings of a seminar held in Kuala Lumpur, 2–7 July 1990. Feldafing, Germany, Food and Agriculture Development Center, German Foundation for International Development Development (ZEL/DSE); Kuala Lumpur, Malaysia, ASEAN Institute of Forest Management.

77 Repetto, R. & Gillis, M. 1988. *Public policies and the misuse of forest resources*. Washington, DC, Cambridge University Press.

78 Romano, F. & Reeb, D. 2006. *Understanding Forest tenure: what rights and for whom?* International Conference on Agrarian Reform and Rural Development, Porto Alegre, Brazil (a study of the situation in Southeast Asia, but with general relevance).

79 Rozelle, S., Jikun Huang & Benziger, V. 2003. *Forest exploitation and protection in reform China: assessing the impact of policy, tenure and economic growth* (available at www.agecon.ucdavis.edu/aredepart/facultydocs /Rozelle/Publications/forest_china.pdf).

80 Schmithusen, F. 1990. *Législation forestiere* – rapport du groupe de travail IUFRO S4.08.03. Zurich, Editeur Herausgeber.

81 White A. & Martin. A. 2002. *Who owns the world's forests: forest tenure and public forests in transition*. Washington, DC, Forest Trends.

Feasibility assessment

82 Asian Development Bank. 1987. *Environmental guidelines for development projects - forestry*. Manila, Asian Development Bank.

83 Bureau of Rural Sciences. 2003. *Impact of forest plantations on water yield, a statement clarifying key scientific issues*. Canberra, Australia, Bureau of Rural Sciences, Government of Australia.

84 Dimitriou, I. & Aronsson, P. 2005. Willows for energy and phytoremediation in Sweden. *Unasylva*, 56(2): 47–50.

85 FAO. 1984. *Land evaluation for forestry*. Forestry Paper No. 48. Rome.

86 FAO. 1993. *Guidelines for land-use planning. Soil resources management and conservation service for the interdepartmental working group on land-use planning*. FAO Development Series No. 1. Rome.

87 Fonseca, H., ed. 2005. *Indigenous peoples: their forests, struggles and rights*. Montevideo, Uruguay, World Rainforest Movement.

88 Gregersen, H.M & Contreras, A.H. 1979. *Economic analysis of forestry projects*. FAO Forestry Paper No. 17. Rome, FAO.

89 ILO. 1989. Indigenous and Tribal Peoples Convention. Geneva, International Labour Organization (also available at www.unhchr.ch/html/menu3/b/62.htm).

90 Ministère français de la Coopération et du Dévelopment. 1979. *Guide d'evaluation economique et financiere des projects forestiers*. Méthodologie de la Planification.

91 Zimmermann, R.C. 1982. *Environmental impact of forestry, guidelines for its assessment in developing countries*. FAO Conservation Guide No. 7. Rome.

Planted forest establishment

92 ACIAR. 1996. *Matching trees and sites*. Aciar Proceedings No 63. Proceedings of an international workshop held in Bangkok, Thailand, 1995. Canberra, Australia, Australian Centre for International Agricultural Research.

93 Agenzia per la Protezione dell'Ambiente e per i Servizi Tecnici (APAT), International Union of Forest Research Organizations (IUFRO) & Dalarna University. 2003. *Nursery production and stand establishment of broadleaves to promote sustainable forest management.* Proceedings of a conference hosted by APAT, IUFRO & Dalarna University, Rome, Italy, 2001.

94 Appanah, S. & Weinland, G. 1993. *Planting quality timber trees in peninsular Malaysia*, Malayan Forest Records No. 38. Kepong, Kuala Lumpur, Forest Research Institute Malaysia (FRIM).

95 CFI. 1980. *A guide to species selection for tropical and subtropical plantations.* Tropical Forestry Papers No. 15. Oxford, UK, Department of Forestry, Commonwealth Forestry Institute, Unversity of Oxford; London, Overseas Development Administration.

96 FAO. 1992. *Mixed and pure forest plantations in the tropics and subtropics.* FAO Forestry Paper No. 103. Rome.

97 FAO. 1995. *Selecting tree species on the basis of community needs.* Community Forestry Field Manual No. 5. Rome.

98 FAO. 2004. Are genetically modified trees a threat to forests?, by El-Lakany, M.H. 2004. In *Forest Threats*. *Unasylva*, 55(2) (also available at www.fao.org/documents/docrep/ 007/y5507e/y5507e00.htm).

99 FAO. 2004. *Preliminary review of biotechnology in forestry, including genetic modification.* Forest Genetic Resources Working Paper No. 59, Rome (also available at www.fao.org/documents/docrep/008/ae574e/AE574E00.htm).

100 FRIM. 2002. *A manual for forest plantation establishment in Malaysia.* Baskaran Krishnapillay, ed. Malayan Forest Records No. 45. Kepong, Kuala Lumpur, Forest Research Institute Malaysia.

101 Lamprecht, H. 1989. Afforestation. In *Silviculture in the tropics*. Gesellschaft für Technische Zusammenarbeit (GTZ). Hamburg, Verlag Paul Parey.

102 Lugo, A.E. 1988. Ecosystem rehabilitation in the tropics. *Environment*, 30(7): 97–20, 41–45.

103 Nepstad, D., Uhl, C. & Serrao, E.A. 1990. Surmounting barriers to forest regeneration in abandoned, highly degraded pastures (Paragominas, Para, Brazil). *In* A.B. Anderson, ed. *Alternatives to deforestation: steps towards sustainable utilization of Amazon forests*. New York, Columbia University Press.

104 UAIC, Congo. 1985. *Eucalyptus en République Populaire du Congo - experience originale d'afforestation industrielle par la technique du bouturage*. Communication au IXe Congrés Forestier Mondial, Mexico, 1985. Pointe-noire, Congo, Unité d'afforestation industriellle du Congo.

105 World Wide Fund for Nature (WWF). 1999. *Position paper on genetically modified organisms (GMOs)*. WWF Position Paper 1 May 1999 (also available at http://assets.panda.org/downloads/gmospositionpaperwwfinternational1999.pdf).

Post-establishment management

106 CGIAR. Undated. *System-wide programme on IPM*. Web sites: www.spipm.cgiar.org/; Consortium for International Crop Protection (GICP), IPMnet: www.ipmnet.org/.

107 FAO. 1987. *Appropriate wood harvesting in plantation forests*. FAO Forestry Paper No. 78. Rome.

108 FAO. 2002. *International code of conduct on the distribution and use of pesticides* (revised version). Rome.

109 FAO. 2004. *Preliminary review of biotechnology in forestry, including genetic modification*. Forest Genetic Resources Working Paper No. 59. Rome.

110 FAO. 2005. *Alien and invasive species: impacts on forests and forestry*. Rome (available at www.fao.org/forestry/site/27082/en).

111 FAO. 2005. *Invasive tree species database*. Rome (available at www.fao.org/forestry/site/ 24110/en).

112 FAO. Undated. IPM Web site: www.fao.org/ag/AGP/AGPP/IPM/Default.htm.

113 Fearnside, P.M. 1987. Jari at age 19: lessons for Brazil's silvicultural plans at Carajas. *Interciencia*, 13(1): 12–24.

114 *Global IPM Facility* – FAO, United Nations Development Programme (UNDP), World Bank & United Nations Environment Programme (UNEP) collaborative programme. Web site: www.fao.org/ag/AGP/AGPP/IPM/gipmf/index.htm.

115 International Plant Protection Centre (IPPC). Undated. *Database of IPM resources (DIR*). Web-based international information retrieval and referral system and compendium of customized directories of worldwide IPM information resources. Web site: www.ippc.orst.edu/cicp/.

116 IPM Collaborative Research Support Programme (IPM CRISP). Blacksburg, VA, Office of International Research, Education and Development, Virginia Tech. Web site: www.ag.vt.edu/ipmcrsp/index.asp.

117 Lamprecht, H. 1989. *Silviculture in industrial tree plantations*. Chapter 8 in *Silviculture in the Tropics*. Verlag Paul Parey, Hamburg for Gesellschaft für Technische Zusammenarbeit (GTZ).

118 Melack, J.M. 2001. *Planning and management of lakes and reservoirs: an integrated approach to eutrophication*. Nairobi, United Nations Environment Programme (UNEP) (an abridged version of the book is available at www.unep.or.jp/ie.index.asp).

119 Toro, J. & Gessel, S. 1999. Radiata pine plantations in Chile. *New Forests*, 18(1): 33–44.

120 UNECE. *International forest fire news*. Semi-annual publication. Geneva, United Nations Economic Commission for Europe (also available at www.fire.uni-freiburg.de).

Spatial information systems, forest systems, forest systems analysis

121 Bossel, H. & Bruenig, E.F. 1992. *Natural resource systems analysis – ecological and socio-economic systems and sensitivity analysis for conservation and management of forest ecosystems and natural resources in South-East Asia*. With contributions by S. Buhman (Cosmos) & A. von Hesler. Doc. No. 1655 A/a-TK 78-300-89 ex. Feldafing, Germany, Food and Agriculture Development Center, German Foundation for International Development (ZEL/DSE).

122 Bruenig, E.F., Bossel, H., Elpek, K.P., Grossmann, K.D., Schneider, T.W., Wang Zhu-Hao & Yu, Zuo-Yue. 1986. *Ecological-socioeconomic system analysis and simulation: a guide for application of system analysis to the conservation, utilization and development of tropical and subtropical land resources in China*. Hamburg, Institute of World Forestry. Feldafing, Germany, Food and Agriculture Development Center, German Foundation for International Development (ZEL/DSE); Bonn, Germany, 'Man and the Biosphere' Nat. Comm. Mitt. 24.

123 Bruenig, E.F., Cosmos, S. & Lau, J. 1993. *Concept and functioning of IMSIS: a demonstration with a practical case study in Sarawak*. Sarawak GIS Conference and Exhibition, Kuching, 14–16 January 1993. Kuching, Forest Department Sarawak.

124 Plantation Information Network. Undated. Web-based information products, reports, links and data for Australia, including commercial environmental forestry products (available at http://adl.brs.gov.au/mapserv/plant/project_list.phtml).

Harvesting

125 FAO. 1996. *Model code of forest harvesting practice,* by Dennis P. Dykstra & Rudolf Heinrich. Bogor Barat, Indonesia, CIFOR; Rome, FAO.

126 FAO. 2003. *Code regional d'exploitation forestiere a faible impact dans les forets denses tropicales humides d'Afrique Centrale et de l'Ouest*. Rome, FAO-EC Partnership Programme.

127 FAO. 2005. *Regional code of practice for reduced-impact forest harvesting in tropical moist forests of West and Central Africa*. Rome, FAO-EC Partnership Programme.

Fire management

128 Bukmam, J.M. 2006. *Chief fire officer's desk reference*. Fairfax, VA, International Association of Fire Chiefs.

129 FAO. 2002. *Guidelines on fire management in temperate and boreal forests*. Forest Protection Working Papers, Working Paper FP/1/E. Rome

130 Global Fire Monitoring Center (GFMC). Undated. Web site: www.fire.uni-freiburg.de/.

131 Goh, K.T., Schwela, D.H., Goldammer, J.G. & Simpson O. 1999. *Health guidelines for vegetation fire events. Background papers*. Published on behalf of the United Nations Environment Programme (UNEP), the World Health Organization (WHO) & the World Meteorological Organization (WMO). Singapore, Institute of Environmental Epidemiology, Ministry of the Environment; Singapore, Namic Printers.

132 Goldammer, J.G. & de Ronde, C., eds. 2004. *Wildland fire management handbook for sub-Sahara Africa.* Freiburg, Germany, Global Fire Management Center; Cape Town, South Africa, Oneworldbooks.

133 ITTO. 1997. *ITTO guidelines on fire management in tropical forests*. ITTO Policy Development Series No. 6. Yokohama, Japan, International Tropical Timber Organization. Web site: www.fire.uni-freiburg.de/programmes/itto /itto.htm.

134 Jurvelius, M. & Luukkanen, O. 2007. *Wildland fire management handbook for trainers.* Helsinki, Ministry of Foreign Affairs, Finland.

135 Schwela, D.H., Goldammer, J.G., Morawska, L.H. & Simpson, O. 1999. *Health guidelines for vegetation fire events. Guideline document.* Published on behalf of UNEP, WHO & WMO. Singapore, Institute of Environmental Epidemiology, Ministry of the Environment; Singapore, Double Six Press.

136 Schwela, D.H., Morawska, L.H. & Abu Bakar bin Jafar. 1999. *Health guidelines for vegetation fire events. Teachers' guide.* Published on behalf of UNEP, WHO & WMO. Singapore, Institute of Environmental Epidemiology, Ministry of the Environment; Singapore, Double Six Press.

Employment

137 ILO. 1998. *Code of practice on safety and health in forestry work*. Report of the Tripartite Meeting of Experts, Geneva, 1998. Geneva, International Labour Organization (also available at www.ilo.org/public/english/protection/safework/ cops/english/download/e981284.pdf).

138 ILO. 2000. *Approaches to labour inspection in forestry – problems and solutions*. Geneva, International Labour Organization (also available at www.ilo.org/public/english/dialogue/sector/ papers/forestry/wp155.pdf).

139 ILO. 2001. *Globalization and sustainability: forestry and wood industries on the move.* Report for discussion at the Tripartite Expert Meeting on the Social and Labour Dimensions of the Forestry and Wood Industries on the Move, Geneva, 2001 (also available at www.ilo.org/public/english/dialogue/sector/techmeet/ tmfwi01/tmfwir.pdf).

140 ILO. 2005. *Guidelines for labour inspection in forestry*. Meeting of Experts to Develop Guidelines for Labour Inspection in Forestry, ILO, Geneva, 2005 (also available at www.ilo.org/public/english/dialogue/sector/techmeet/melif05/ guidelines.pdf).

141 Poschen, P. 2000. *Social criteria and indicators for sustainable forest management. A guide to ILO texts*. ILO/GTZ Forestry Certification Project Working Paper No. 3. Geneva, International Labour Organization (also available at www.ilo.org/public/english/dialogue/sector/papers/forestry/gtz1.pdf).

Annex 6: FAO Working Paper series on planted forests

Planted Forest Working Papers: Thematic Paper Series

Note: In code "Working Paper FP/x", "x" indicates the WP series number and a suffix E, F or S indicates: E = English, F = French, S = Spanish, in case of multilingual papers. No suffix indicates English only.

Available at the Planted Forest Web site: www.fao.org/forestry/site/10368/en.

Working Paper FP/1	*Mean Annual Volume Increment of Selected Industrial Species*. Ugalde L. and Perez O. April 2001.
Working Paper FP/2	*Biological Sustainability of Productivity in Successive Rotations*. Evans J. March 2001.
Working Paper FP/3	*Plantation Productivity*. Libby W.J. March 2001.
Working Paper FP/4	*Promotion of Valuable Hardwood Plantations in the Tropics. A Global Overview*. Odoom F.K. March 2001.
Working Paper FP/5	*Plantations and Wood Energy*. Mead D.J. March 2001.
Working Paper FP/6	*Non-Forest Tree Plantations*. Killmann W. March 2001.
Working Paper FP/7	*Role of Plantations as Substitutes for Natural Forests in Wood Supply – Lessons learned from the Asia-Pacific Region*. Waggener T. March 2001.
Working Paper FP/8	*Financial and Other Incentives for Plantation Establishment*. Williams J. March 2001.
Working Paper FP/9	*Impact of Forest Policies and Legislation on Forest Plantations*. Perley C.J.K. March 2001.
Working Paper FP/10	*Protecting Plantations from Pests and Diseases*. Ciesla W.M. March 2001.
Working Paper FP/11	*Forestry Out-Grower Schemes: A Global View*. Race D. and Desmond H. March 2001.

Working Paper FP/12	*Plantations and Greenhouse Gas Mitigation: A Short Review*. Moura-Costa P. and Aukland L. March 2001.
Working Paper FP/13	*Future Production from Forest Plantations*. Brown C. March 2001.
Working Paper FP/14	*Forest Plantation Resources, FAO Data Sets 1980, 1990, 1995 and 2000.* Del Lungo, A. December 2001
Working Paper FP/15	*Global Forest Plantation Development: Review for FRA 2000.* Vuorinen A.P. and Carle, J.B. April 2002
Working Paper FP/16S	*Bibliografía Anotada Sobre los Efectos Ambientales, Sociales y Económicos de los Eucaliptos*. Compilación de documentos elaborados en inglés, francés y español entre 1985 y 1994. Marzo de 2002.
Working Paper FP/16E	*Annotated Bibliography on Environmental, Social and Economic Impacts of Eucalyptus*. Compilation from English, French and Spanish Literature, 1985 to 1994. Revised (Combined) Edition, March 2002.
Working Paper FP/17S	*Bibliografía Anotada Sobre los Efectos Ambientales, Sociales y Económicos de los Eucaliptos*. Compilación de documentos elaborados en inglés, francés y español entre 1995 y 1999. Palmberg C., Marzo de 2002.
Working Paper FP/17E	*Annotated Bibliography on Environmental, Social and Economic Impacts of Eucalyptus*. Compilation from English, French and Spanish Literature, 1995 to 1999. Palmberg C., March 2002.
Working Paper FP/18	*Tropical forest plantation areas 1995 data set*. Pandey D. May 2002.
Working Paper FP/19	*Teak (Tectona grandis) in Central America*. De Camino, R.V., Alfaro, M.M. and Sage, L.F.M. May 2002.
Working Paper FP/20	*Melina (Gmelina arborea) in Central America*. Alfaro, M.M. and De Camino, R.V. May 2002.
Working Paper FP/21	*Case study of hardwood programmes in Fiji, Solomon Islands and Papua New Guinea*. Hammond, D. May 2002.
Working Paper FP/22	*Case study of long rotation eucalypt plantations in New South Wales*. Heathcote, R. June 2002.

Working Paper FP/23	*Case study of the tropical forest plantations of Malaysia*. Krishnapillay, D.B. June 2002.
Working Paper FP/24	*Hardwood plantations in Ghana*. Odoom, F. June 2002.
Working Paper FP/25	*Planted Forests Database (PFDB): Structure and Contents.* Varmola, M. and Del Lungo, A. July 2003.
Working Paper FP/26	*Planted Forest Database: Analysis of Annual Planting Trends and Silvicultural Parameters for Commonly Planted Species.* Del Lungo, A. September 2003.
Working Paper FP/27E	*Role of Planted Forests and Trees Outside Forests in Sustainable Forest Management: Republic of Tunisia - Country Case Study*. Rouchiche, S. and Abid, H. October 2003.
Working Paper FP/27F	*Rôle des Plantations Forestières et des arbres hors forêts dans l'aménagement forestier durable: République de Tunisie - Raport par pays.* Rouchiche, S. and Abid, H. October 2003.
Working Paper FP/28E	*Role of Planted Forests and Trees Outside Forests in Sustainable Forest Management: Republic of Mali - Country Case Study*. Thomas, I. and Samassekou, S. October 2003.
Working Paper FP/28F	*Rôle des Plantations Forestières et des arbres hors forêts dans l'aménagement forestier durable: République du Mali - Raport par pays.* Thomas, I. and Samassekou, S. October 2003.
Working Paper FP/29E	*Role of Planted Forests and Trees Outside Forests in Sustainable Forest Management: Republic of Ethiopia - Country Case Study*. Thomas, I. and Bekele, M. October 2003.
Working Paper FP/29F	*Rôle des Plantations Forestières et des arbres hors forêts dans l'aménagement forestier durable: République d'Éthiopie - Raport par pays.* I. Thomas et M. Bekele. October 2003.
Working Paper FP/30E	*Role of Planted Forests and Trees Outside Forests in Sustainable Forest Management: Republic of Namibia - Country Case Study*. Thomas, I. and Chakanga, M. October 2003.
Working Paper FP/30F	*Rôle des Plantations Forestières et des arbres hors forêts dans l'aménagement forestier durable: République de Namibie - Raport par pays.* I. Thomas et M. Chakanga. October 2003.

Working Paper FP/31E	*Role of Planted Forests and Trees Outside Forests in Sustainable Forest Management: Sultanate of Oman - Country Case Study*. Rouchiche, S. October 2003.
Working Paper FP/31F	*Rôle des Plantations Forestières et des arbres hors forêts dans l'aménagement forestier durable: Sultanat d'Oman - Raport par pays*. S. Rouchiche. October 2003.
Working Paper FP/32E	*Role of Planted Forests and Trees Outside Forests in Sustainable Forest Management: Islamic Republic of Iran - Country Case Study*. Rouchiche, S. and Haji Mirsadeghi, M. A. October 2003.
Working Paper FP/32F	*Rôle des Plantations Forestières et des arbres hors forêts dans l'aménagement forestier durable: République Islamique d'Iran - Raport par pays*. S. Rouchiche. October 2003.
Working Paper FP/33	*Potential for Fast-Growing Commercial Forest Plantations to Supply High Value Roundwood*. R. James and A. Del Lungo. February 2005.
Working Paper FP/34	*Netherlands Trust Fund Support to Sustainable Forest Management in Low Forest Cover Countries. - the Role of Planted Forests and Trees Outside Forests in Landscape Restoration in Low Forest Cover Countries*.
Working Paper FP/35E	*Global Planted Forests Thematic Supplement to Forest Resources Assessment 2005. - Guidelines for National Reporting Tables for Planted Forests*. A. Del Lungo and J. Carle. April 2005.
Working Paper FP/35F	*Supplément thématique sur les forêts plantées à l'Évaluation des ressources forestières 2005. - Directives pour l'élaboration des tableaux nationaux d'information sur les forêts plantées*. A. Del Lungo et J. Carle. Avril de 2005.
Working Paper FP/35S	*Suplemento temático sobre los Bosques plantados de la Evaluación de los Recursos Forestales 2005. - Directrices para la elaboración de las tablas informativas nacionales sobre los bosques plantados*. A. Del Lungo y J. Carle. Abril de 2005.
Working Paper FP/35aE	*Global planted forests thematic: country responses to reporting tables for planted forests survey*. A. Del Lungo and J. Ball, 2006.

Working Paper FP/35bE	*Global planted forests thematic: supplementary desk study on planted forests*. A. Del Lungo and J. Ball, 2006.
Working Paper FP/36E	*Management of wood properties in Planted Forests. A paradigm for global forest production*. R. Jagels. June 2006.
Working Paper FP/37E	*Responsible Management of Planted Forests: Voluntary Guidelines*. Forest Resources Development Service, FAO, December, 2006
Working Paper FP/38E	*Global planted forests thematic: results and analysis*. A. Del Lungo, J. Ball, J. Carle, December, 2006.